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ANNOUNCEMENT

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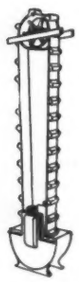
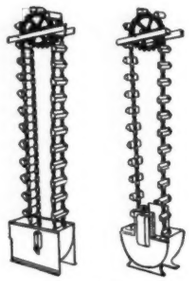
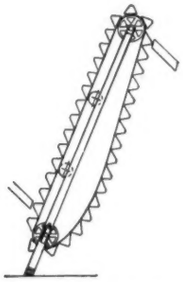


Centrifugal Discharge Belt and Bucket Elevator



Centrifugal Discharge Chain and Bucket Elevators

Positive Discharge Bucket



Continuous Bucket Elevator

Standard Types of Bucket Elevators

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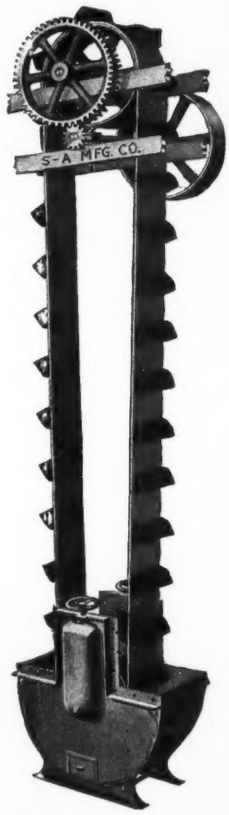
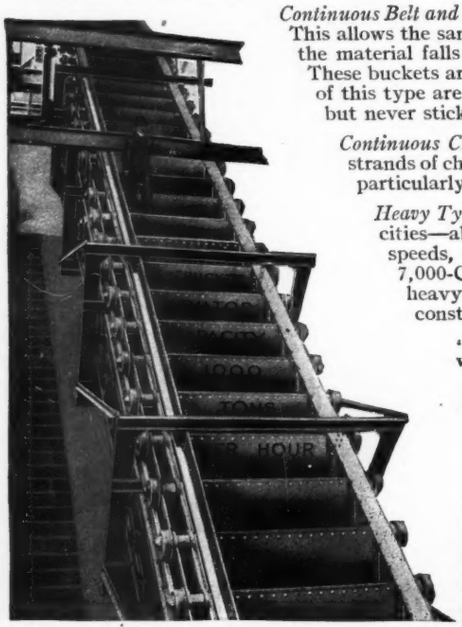
Centrifugal Discharge Chain and Bucket Elevators. The buckets are carried on a chain, either single or double strand, rather than a belt. They are usually less expensive than the previous type, but are less satisfactory from the operating standpoint, except for handling hot or gritty materials, or under other conditions for which a belt is not adapted.

Positive Discharge Elevators carry spaced buckets between two strands of chain. At the head end a pair of idler sprockets draws back the buckets, completely inverting them and allowing a positive gravity discharge.



Mill Type Centrifugal Discharge, Belt and Bucket Elevator



Continuous Belt and Bucket Elevators have the buckets attached to the belt without intervening spaces. This allows the same capacity at a lower speed; the discharge is, consequently, not centrifugal, but the material falls from each bucket over the back of its leading bucket and thence to the spout. These buckets are not loaded from a boot, but receive direct from the loading spout. Elevators of this type are most satisfactory for handling lump material—crushed stone, coal or gravel, but never sticky material.

Continuous Chain and Bucket Elevators have the buckets spaced continuously on one or two strands of chain. They are used under conditions similar to the preceding type of elevator, but particularly for hot or gritty materials or where conditions require a less expensive elevator.

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Mining Journal

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The Cerro de Pasco District, Peru

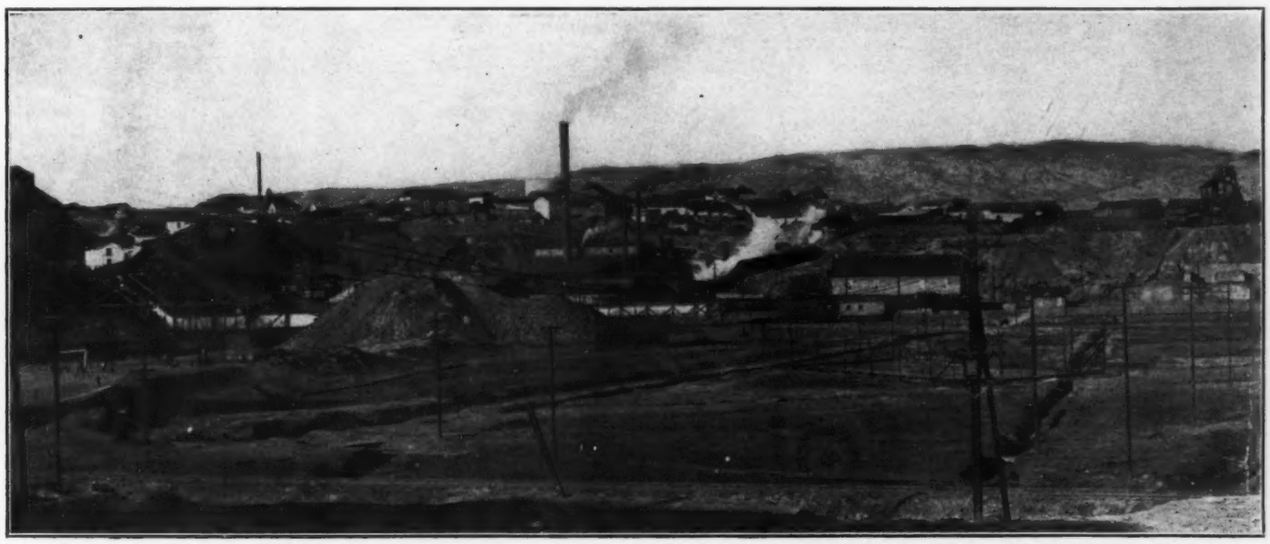
By Joseph T. Singewald, Jr.,* and Benjamin LeRoy Miller†

SYNOPSIS—From 1630 to 1898 Cerro de Pasco was a silver camp. With the advent of the Cerro de Pasco Mining Co., copper mining began in earnest. Ores occur in rhyolite conglomerates and tuffs. Oxidized silver ores of little importance today but copper-sulphide ores, now being mined, carry silver and a small amount of gold. Geology of the district is discussed at some length and the mining and smelting methods are outlined.

The Cerro de Pasco mining district was discovered in 1630 and until 1898 was a silver-mining camp. During this period only the oxidized, or *pacos,* ores were worked and it has been estimated that a total of 9,000,000 tons of ore yielding an aggregate of $565,000,000 was taken out. These ores were treated in the neighborhood in many small amalgamation plants using the patio process. An enormous number of these was erected, and it is estimated they had a total capacity of 185,000 tons per year, although only a small fraction were ever in operation at any one time. After the district had been long on the decline, it suffered a great setback in 1893 when the price of silver dropped so low, and another in 1897 when the Peruvian government refused to coin any more silver.

The copper-sulphide ores had been worked only sufficiently to supply the copper sulphate required in the patio process, but in 1897 the smelting of these ores to matte was commenced, and in a short time a dozen or more small plants were erected. Ores ranging above 30% Cu were exported to Europe or sold to the Yauli and Casapalca smelters, and those lower in copper were reduced to matte for exportation. The first blast furnace in the region was that of E. E. Fernandini at Hauraucaca. In 1898 an American syndicate became interested in many of the mines, and in 1902 the Cerro de Pasco Mining Co. was organized. This company's smeltery at La Fundicion was put in operation in 1906 and again placed Cerro de Pasco among the foremost metal-producing districts of the world, but this time as a producer of copper.

The principal operator is the Cerro de Pasco Mining Co., but E. E. Fernandini, a Peruvian, is an important producer though on a much smaller scale, and in addition there are several other small producers. The Cerro de Pasco Mining Co. obtains its coal supply from its own coal mines to the north of Cerro de Pasco; has at La Fundicion, 14 km. south of the mines, a smelting plant that is producing over 6,000,000 lb. of copper per month; near Oroya it has built a 12,000-hp. hydro-electric plant with a 70-mi. transmission line; the company completed and operates the Cerro de Pasco R.R., running from Cerro de Pasco to connect with the Ferrocarril Central del Perú at Oroya, a distance of 132 km., with branch lines to the coal mines, 58 km. long. It is estimated that 25 to 30 million dollars has been invested by this company in Peru, which is probably the largest sum ever invested in a copper operation and certainly the largest investment of Amer-



LOOKING ACROSS CERRO DE PASCO FROM MINING COMPANY'S GENERAL OFFICE

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†Professor of geology, Lehigh University, South Bethlehem, Penn.

ican capital in a single mining enterprise in South America, though recently it has been closely seconded by the investment of the Chile Copper Co. at Chuquicamata in Chile.

The output of the Cerro de Pasco mines is over 30,000 tons per month. The ores carry copper as the most valuable constituent, with appreciable quantities of silver and gold. The average grade of the ore shipped from the district is about 11 oz. silver and 7% copper. The ratio of precious metals to copper is such that the blister copper carries 1 oz. Au and 140 oz. Ag per ton. Though this may seem low for a district that was at one time a producer of silver only, these precious metals add appreciably to the value of the ores.

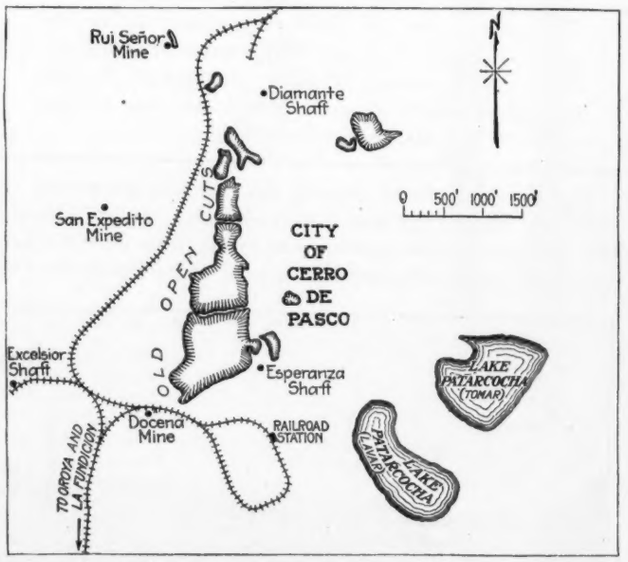
The Cerro de Pasco district is situated in the midst of a group of low hills on the *pampa* between the two ranges of the Andes at an elevation of a little more than 14,000 ft. The distance by rail from Lima is 342 km., and the elevation at the Cerro de Pasco station is 14,208 ft. Owing to the comparatively low relief, this also represents approximately the elevation of the mines. Except for the absence of trees and the rapid change in temperature accompanying the appearance and disappearance of the sun, it would be difficult to realize the great elevation, as the only rugged snow-capped mountains visible are far away on the horizon.

Ore Found in Rhyolite Agglomerates and Tuffs

The greater part of the country in the vicinity consists of limestones and limestone conglomerates associated with which are some shales and sandstones. These sedimentary rocks are of Mesozoic and probably chiefly Cretaceous age. They have been cut by numerous igneous intrusions, and immediately to the west and northwest of the town of Cerro de Pasco is an area of igneous rock surrounded by limestone, which has a diameter of about 1¾ mi. and has the composition of rhyolite. Roughly, the western part of this area of igneous rock consists of rhyolite and the eastern part of rhyolite agglomerates and tuffs. The ore deposits are found mainly in the rhyolite agglomerates and tuffs, and the greatest mining activity has centered in the southeastern part of this area in the immediate vicinity of the City of Cerro de Pasco.

The area between the Esperanza and the Diamante shafts was the scene of the greatest activity in the days when this was a silver-producing camp. Down to a depth of as much as 100 ft. this area was underlain by a great mass of oxidized argentiferous material known as the *pacos* ores, the richer portion of which was worked first by means of opencuts and later also by shallow underground mining. The huge underground caves left unsupported have since collapsed and increased the size of the opencuts, leaving the series of immense pits, or *tajos abiertos,* as evidence of the great amount of material removed in those days. The silver content of the *pacos* material left behind varies greatly, but the copper content is almost uniformly negligible. It is an excellent example of enrichment in silver and leaching of copper in the zone of oxidation. Even to this day local patches of *pacos* ores are found that carry enough silver to make them profitable and are worked by raising on them and allowing them to cave into the lower sulphide stopes. The oxidized ores, which were the source of Cerro de Pasco's riches for several centuries, are of practically no importance in the present mining activity of the district.

Below the oxidized zone an enormous mass of low-grade pyritic ore is encountered that for the most part is too low-grade to be workable at present. At the north end, in the vicinity of the Diamante shaft, there is a layer of rich copper ore between the zone of oxidation and the deeper-lying lean pyrite. On the other hand, the latter in depth grades over into an ore carrying appreciable quantities of galena and sphalerite. A little farther south toward the Esperanza shaft, the principal oreshoot of the mine, the Piña Blanca, is encountered. This ore is a mixture of pyrite with enargite and famatinite, and in places consists almost entirely of the copper minerals. Here and there a little patch of galena is found, and from level 4 down, the north side of this oreshoot carries abundant galena and sphalerite. Several distinct veins of high-grade ore of the kind found in the Piña Blanca cut the mass of low-grade pyrite. Much of this rich ore consists of soft drusy enargite and famatinite and has the



SKETCH MAP OF PART OF CERRO DE PASCO DISTRICT

appearance of secondary sulphides formed within the mass of lean primary pyritic material. Such an interpretation is contrary to the evidence of Graton and Murdoch, obtained in their study of the copper minerals in general, who say "the mineral (enargite) appears to be practically in all cases primary," and the richer shoots may simply be due to a large extent at least to primary sulphide enrichment.

This sulphide-ore mass is evidently a replacement stock in a country rock of rhyolite agglomerate and tuff. About its periphery there has been also a great deal of silicification, so that considerable dark cherty-looking silica occurs in places, for the most part as bands and lumps that grade outward into soft altered rhyolitic material.

Separated from the larger sulphide mass by about 100 to 200 ft. of intensely sheared rock, the original character of which has been obscured by this metamorphism but which is probably the same igneous material, is a smaller orebody known as the Noruega. This lies to the east of the south end of the Piña Blanca. It is an orebody evidently identical in character and genesis with the other. The country rock is a soft altered rhyolitic rock in places grading into the same kind of black cherty silica impregnated with more or less pyrite. The main ore mass con-

sists of a lean pyrite that is frequently so sugary in texture as to readily disintegrate to a sand which it is almost impossible to keep from running in the stopes. Within this are the richer shoots of enargite ore.

Cross-Veins Representing Different Type of Orebody

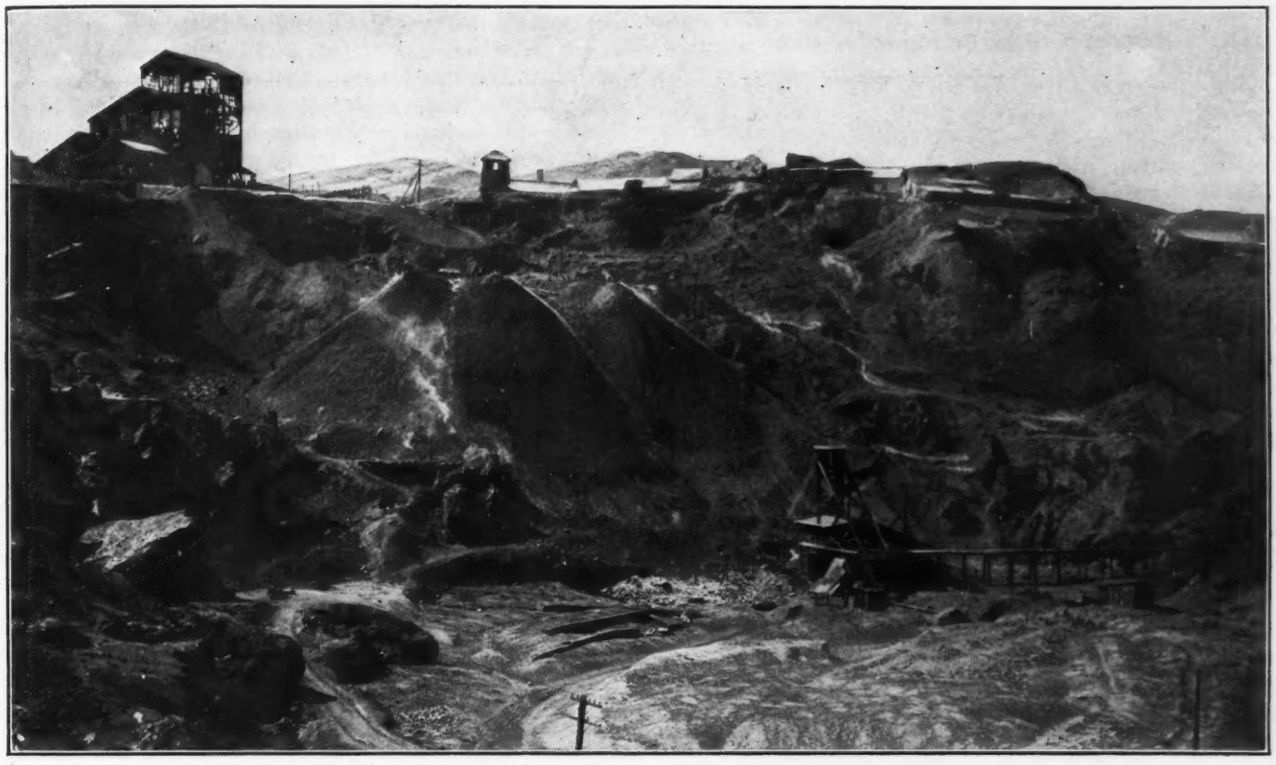
An entirely different type of orebody is represented by the cross-veins, which are a series of veins with an east-west strike on the west side of the sulphide stocks. The most important of these are found in a belt directly west of the south end of the Piña Blanca shoot. They have a northerly dip of about 67° and an average width of 5 ft. In order from south to north, the principal ones are known as the Cleopatra, the Docena, the Bolognesi and the San Ancelmo. Quartz and pyrite are the most abundant minerals in the vein filling; the principal copper minerals are enargite and famatinite; considerable tetrahedrite and some chalcopyrite occur. Luzonite, a dimorphous form of enargite, is said to occur, but none was seen in this group of veins, though it was collected in ore from some of the veins to the north of this group. Rich pockets and shoots also occur in the veins, but on the whole the copper minerals are sufficiently well distributed to make the veins workable through practically their entire extent.

The country rock of the veins consists of the various phases of the rhyolitic rock. Near the Esperanza shaft it consists of the highly sheared rock mentioned in connection with the sulphide masses; farther west it passes into the rhyolite agglomerate, and in the vicinity of the Excelsior shaft it is the true rhyolite.

The Cerro de Pasco Mining Co. is working these orebodies through three shafts, of which the Esperanza, about 900 ft. north of the railroad station, is the principal one. The sulphide stocks are worked through it and the Diamante shaft a little over a half-mile to the north, and the cross-veins through it and the Excelsior shaft about the same distance to the west. The maximum depth reached is 600 ft. An important independent mine in the belt of the cross-veins is the Docena. Several smaller mines are working veins of similar character to the north of these, among which the most important are the Rui Señor and the San Expedito. The latter is such an interesting example of occurrence of ore in well-defined shoots that a description of it will be given.

Ore Occurrence in San Expedito Mine

The San Expedito mine is situated about midway between the Excelsior and Diamante shafts and is a small mine worked through two shafts 60 m. deep. It is being operated under lease by Bartolomé Novoa, who ships the ore to the smelting works at La Fundicion. The country rock is a rhyolite agglomerate with which is associated more or less tuff showing distinct stratification. Cutting this rock are three veins, known as the Bronce, Parallel and San Expedito, with the strike relations shown in the sketch. The dip is steep to the north or northwest.



ONE OF THE LARGE "PACO" OPENCUTS AT ESPERANZA SHAFT, CERRO DE PASCO

In the upper levels only the San Expedito and Parallel veins are present, but the latter does not extend below 50 m. in depth. The Bronce vein first appears at that depth, unites with the San Expedito to the west, and beyond the junction determines the course of the united veins. These veins are by no means workable throughout their whole extent, but the profitable ore occurs in distinct oreshoots of limited size. The largest oreshoot is one in the San Expedito vein, which is encountered at a depth of 30 m. at the point *A*, where the stringer from the parallel vein unites with that vein. It has a flat westerly pitch and at a depth of 50 m. is found at the junction of the San Expedito and Bronce veins. On the 50-m. level at the

point *C*, in the Bronce vein, there was a small pocket of rich ore that contained 150 tons carrying 25% Cu. The copper content of the ore mined is above the average for the district, but the silver content is low. The most distinctive form of the shoots is that of small horizontally elongate masses that Mr. Novoa appropriately likens to sausages. Many of them are only 1 to 2 m. wide with the same height and a length of about 10 m.

As is commonly the case in the veins of the district, the most abundant minerals are quartz and pyrite. The valuable copper mineral is enargite, some of which occurs in the form of luzonite, and there is also some tetrahedrite present. Massive gypsum, as well as a little selenite, was seen at several places in the veins. There is no apparent system in the distribution of the oreshoots, and for that reason the method of mining is most irregular and consists merely of drifting about from one in search of another. Consequently the most primitive native methods of mining are employed.

Treatment of the Sulphide Ores

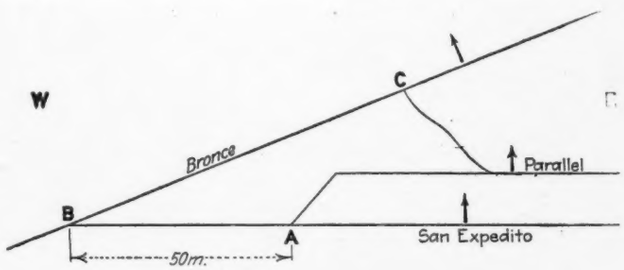
Since the *pacos* silver ores are no longer a factor in the district, the many small patio plants have long since been abandoned. The small copper-matte smelteries were not able to compete with the two large smelting plants and have also succumbed. The presence of modern smelting works has done away with the advantage of exporting the richer ores, and consequently all the production of the district is handled in the two works of the Cerro de Pasco Mining Co. and E. E. Fernandini. At the mine the ores are subjected to no other preliminary treatment than hand-sorting. At La Fundicion the crude ore is screened over ¾-in. screens and the oversize smelted at once. Undersize is sintered on six Dwight-Lloyd machines, with a total capacity of 250 tons daily.

The Cerro de Pasco Mining Co. has at La Fundicion a thoroughly modern smelting plant. The ores are received in twelve 2,000-ton steel ore bins that are filled from the railroad tracks over them. There are six reverberatory furnaces and four water-jacket blast furnaces having a daily capacity of about 300 tons. The slag is granulated and runs out on the hillside below the works. In the converter department there are seven stands. Coke is made in the company's coke plant, consisting of seventy 75-ton beehive ovens, from coal obtained from its own mines. Fire and silica brick are made at its brick plant. A limestone quarry on the railroad between the mines and the smeltery furnishes flux. A 12,000-hp. hydro-electric plant furnishes ample power both for the company's operations in this district and for the use of the Morococha Mining Co. in the Morococha district. The diverse activities of this company illustrate well the necessity of having a complete plant capable of supplying practically all of its own needs, if success is to be expected in mining in such distant countries. They also emphasize the need of adequate financial backing and large investments, if such a mining enterprise is not to be hopelessly handicapped in its development.

The Hauraucaca smeltery, of Fernandini, which handles the rest of the ores of the district, is much smaller than Cerro de Pasco's, but it is a well-equipped plant. It consists of two blast furnaces, of 70 and 130 tons' capacity respectively, two roasting furnaces and two reverberatory furnaces. In addition there is a 120-ton concentrating mill with stamps, huntington mill, jigs, Wilfley tables, and vanners in which the silver ores from the Colquijirca mine are concentrated before smelting. Both coal and *taquia* are used for fuel. Power is furnished by a 1,200-hp. hydro-electric plant on the Rio Blanco.

Probably no other outside factor has contributed so much to making this enterprise of the Cerro de Pasco Mining Co. a success as has the presence of workable beds of coal, some of which are of coking character, and for that reason it seems appropriate to say a few words here in regard to the company's coal-mining activities. Although for the most part of rather indifferent quality, this coal has made the company independent of importations of foreign coke and of *taquia*, the dung of the llama, as fuel. It would have been impossible to secure adequate amounts of the latter for an enterprise of such magnitude.

The two principal coal mines are the Goyllarisquisga and the Quishuarcancha, which lie to the north of Cerro de Pasco and are connected with the smelting works by a branch line leaving the main line at Vista Alegre between the copper mines and the smeltery. The Goyllarisquisga branch has a length of 26 mi., and from it branches a 10-mi. line to Quishuarcancha. The region is one of considerable relief with deep gorges. The grade on the railroad is steep and reaches a maximum of 5%. At Quishuarcancha the coal must be hauled up a 3,600-ft. incline



VEIN SYSTEM IN SAN EXPEDITO MINE

through a vertical elevation of 1,400 ft. from the mouth of the mine to the railroad. It is an unusual spectacle to see coal mines in operation at such altitudes as these, ranging from 12,000 to 14,000 ft. above sea level.

The coal is of late Jurassic or Cretaceous age and, associated with fireclay, occurs in a series of white- to gray-colored sandstones. The beds are not very persistent horizontally and vary greatly in thickness. The maximum thickness is 60 ft., but the average of the beds being worked is about 5 to 10 ft. Most of the coal is soft and friable and is high in sulphur and ash. Roughly, it averages one-third fixed carbon, one-third volatile matter and one-third ash. Washing cuts the ash content in half and raises the fuel value to over 12,000 B.t.u.

A Large Demand for Infusorial Earth or diatomite—known also as kieselguhr—for use in the manufacture of dynamite and for metal cleaning and sugar refining, exists in England according to the "London Engineer." The Imperial Institute accordingly suggested to the Australian authorities that various samples of Australian diatomite should be forwarded to the institute for technical examination. Samples were received from Victoria, New South Wales, Western Australia and Tasmania. Those from Victoria and New South Wales proved to be of most promising quality. In particular, samples from the Lillicur deposits, northwest of Ballarat, in Victoria, found favor there with dynamite manufacturers to whom they were submitted, and it is probable that there will be a ready market for Lillicur diatomite in the United Kingdom. Before the war England's principal supply of diatomite was obtained from Germany.

Manganese in South Carolina

By Reginald W. Petre*

Near the town of McCormick, S. C., is a group of old workings known as the Dorn gold mines and with them a corresponding deposit of manganese. The condition of the gold mines, long ago robbed to and a little below the water level, fully justifies the accounts of their former output of between $1,000,000 and $2,000,000, to the Philadelphia and Dahlonega mints.

The country rocks consist of slates and schists with a strike of 60° E. and pitch of about 10° N., forming a section 2,000 ft. long of the great belt running diagonally through Georgia, South and North Carolina and Virginia, on which are situated most of the past and present profitable gold mines of the Southern Appalachians.

The extraordinary concentration of mineral along the three parallel ore courses and its sudden termination where the manganese vein commences, in the entire absence of faulting or intrusive dikes, may possibly be accounted for by the fact that gold remains dissolved when in the presence of manganese oxide and then the gold in original solution in meteoric waters precipitated itself upon the more adaptable iron sulphides, while the manganese oxide became concentrated by itself, beyond and distinct. The distribution of the gold begins abruptly in the Dorn, 900 ft. long enriched from 16 to 30 ft. in width, followed by the Belle, parallel and 300 ft. to the north, opened from 6 to 20 ft. in width and 700 ft. long, then the New York vein, again parallel and 600 ft. north, 8 ft. wide and exposed about 800 ft., to a point where all workable ore disappears. The first manganese outcrop begins 250 ft. to the south and is traced nearly half a mile.

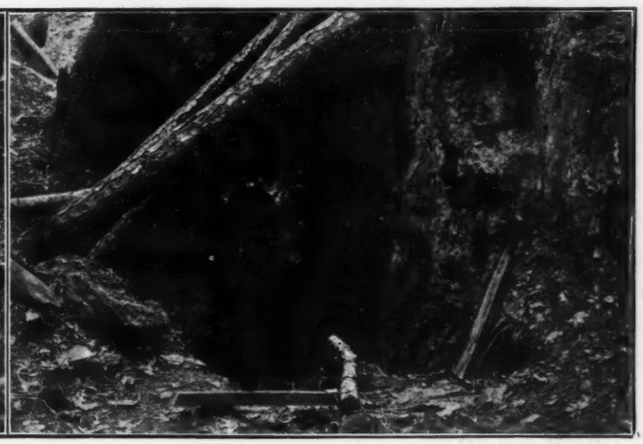
Thus in no place in these ore courses are values abreast of one another, very much as I observed to be the case on the Mother Lode of California, where there is no point between Placerville and Sonora in Tuolumne County where there are two paying mines directly opposite each other. A pious Cornishman with an imagination told me that the Creator had broadcast just so much gold to the fathom, much being scattered in the wind, while some had trickled from the hand of the Great Sower forming the oreshoots, presumably for Cousin Jack himself to garner.

*Mining engineer, Calvert Building, Baltimore, Md.

The manganese vein lies against a thick seam of quartzite forming the hanging wall along the regular strike of the upturned slates and first appears in a bold outcrop of quartz carrying seams of pyrolusite and psilomelane, whether following some rule or not I was unable to discover, but it is not lenticular.

The slates forming the foot wall have become an amorphous mass of red, mottled clay as deep as can be seen in a shaft sunk about 30 ft., or to nearly water level. The manganese is intermingled with rotten quartz stringers, the former predominating and easily separated in the oxidized zone, particularly in offshoots spreading into the soft foot wall, but forms at intervals into large bodies up to 10 ft. in thickness diagonally across the strike, sometimes as much as 40 ft. At certain intervals these shoots are amorphous, soft wad with manganese content above 30% and have been mined to 30 ft., though the material now on the dump was then too low to pay transportation. At certain points along the vein, notably Nos. 1 and 3 openings, the surface soil for about 100 ft. south is highly impregnated with concretionary masses of high-grade manganese, much of which apparently was detached from the vein by the weathering down of the outcroppings, fragments of which have rolled down and subsequently been further enriched by atmospheric waters or the more ordinary method of aggregation of particles. The area of these surface deposits is limited, probably not over two acres, clearly showing their derivation from the vein. The clay is not residual, but decayed slates in place and quite different from such of the Virginia deposits as I have examined. At the first outcrop I picked up 2 tons of high-grade ore from an area of 150x100 ft. and 1½ tons of still higher grade from 50x100 ft. south of No. 3 outcrop, but it is not probable that this ground will be productive for more than a few feet in depth, where there may possibly be beds of considerable size. So far as can now be ascertained, the ore becomes more massive in depth along the vein, though on account of the method of extraction formerly employed, mingled ore and waste being thrown back as work progressed, none of it can be seen in place. Several hundred tons standing in No. 4 cut shown in the photographs, has high metallic contents. I see no reason to doubt the continuation of the ore to considerable depth without material change of value, though general hardness will increase proportionately in the unaltered zone.

EAST OPENING NO. 4. LOOKING EAST ON ORE IN PLACE



EAST OPENING NO. 4. LOOKING WEST, SHOWING WIDTH OF ORE IN PLACE

One vertical diabase dike, 5 ft. thick, penetrates the hanging wall at right angles at a point in the largest workings, but shows no sign of causing any alteration in the vein, nor does it appear in the foot wall, so was evidently formed after the original impregnation. The quartzite hanging wall is cut off abruptly at the western end where the manganese first outcrops and the gold disappears.

The shipping ore contains an average of 43% Mn, 0.16% P, 5.00% SiO_2 and 2.10% Fe, and is composed of an irregular mixture of pyrolusite and psilomelane which, being hard, can be kept apart from the wad. The last shipment of ore was made in 1914 to the Tennessee Coal and Iron Co.—about 500 tons, while the past history of the mine shows shipments to have been regularly made, prior to the war to England from Augusta, Ga., by rafts and boats down the Savannah River to seaboard.

Various Heat-Conducting and Insulating Materials

The following tabulation, compiled by the United States Bureau of Standards and published in Circular No. 55, gives the thermal conductivities in metric units of a number of common materials, also the number of B.t.u. of heat which would pass in one hour through a sheet of the material 1 ft. square and 1 in. thick, with a difference in temperature between the two faces of 1° F. Thermal conductivity in metric units is the amount of heat in calories that will pass in one second through each square centimeter of a plate 1 centimeter thick, if the difference in temperature between the surfaces is 1° C., and is given in Column A; the transmission in B.t.u. per hr., per sq.ft., per in., thickness for each degree F. difference in temperature is shown in Column B.

Material	A	B
1. Silver	1.0	2,900.0
2. Copper	0.9	2,600.0
3. Aluminum	0.5	1,450.0
4. Iron	0.14	400.0
5. Rock	0.0025 to 0.009	0.7 to 26.0
6. Porcelain	0.0025	7.2
7. Brick	0.002 to 0.005	6.0 to 15.0
8. Glass (ordinary)	0.0016	4.6
9. Water	0.0014	4.0
10. Plaster (ordinary)	0.001 to 0.0015	2.9 to 4.3
11. Wood (hard)	0.0006	1.7
12. Asbestos paper	0.00045	1.3
13. Asbestos felt	0.00025	0.7
14. Sawdust	0.00018	0.52
15. Wood (very soft)	0.00015	0.43
16. Paper	0.00013	0.38
17. Cork board	0.00012	0.34
18. Wool	0.00010	0.29
19. Hair felt	0.00010	0.29
20. Cotton wool	0.00009	0.26
21. Feathers	0.000057	0.16

The International Nickel Co.

The fourteenth annual report of the International Nickel Co. for the fiscal year ended Mar. 31, 1916, gives the following figures:

Earnings of all properties after deducting manufacturing and selling expense and ordinary repairs and maintenance, $14,091,612; other income, $249,354; total income, $14,340,966. Administrative and head-office expense, including traveling and legal, office rent, salaries and commissions, corporation and capital-stock taxes, $870,860, leaving net income amounting to $13,470,106.

From net income was deducted for depreciation of plant, $806,000; mineral exhaustion, $900,827; foreign companies not included, $15,000; which leaves the total net profits for the year, $11,748,278. From these profits dividends were paid during the year of $534,756 on the preferred stock and $9,431,803 on the common stock, leaving a balance of undivided profits of $1,781,719 to be added to surplus.

During the fiscal year $1,414,807 was expended for additional property, construction and equipment. The number of stockholders has increased materially and is now 7,145, as compared with 4,465 one year ago.

No technical details whatever of operation are given, but the concluding sentence of the president's report states that "During the past year the operation of the company's plant has been continuous and the result satisfactory to the management."

Copper and Zinc in Japan

According to the *Board of Trade Journal,* the output of copper in Japan during 1915 is estimated at between 70,000 and 75,000 tons, an increase of about 15% over the 1914 output. The exports of copper from Japan were as follows:

	Tons, 1914	Tons, 1915
China	13,850	1,430
Hongkong	2,560	90
British India	2,440	1,220
United Kingdom	6,790	12,200
France	3,470	3,940
Germany	2,100	....
United States	4,680	7,800
Asiatic Russia	5,000	29,000
Other countries	2,110	320
Total	43,000	56,000

Prior to the war the zinc-smelting industry in Japan was a very small one, the output for 1914 being estimated at 5,000 tons. Cessation of competition, however, gave a great impetus to the industry, and the production in 1915 amounted to 16,000 to 18,000 tons, while it is expected to reach 25,000 tons in 1916. Exports of refined zinc from Japan in 1915 amounted to 5,300 tons, mainly to the United Kingdom, France and Russia. Zinc concentrates were obtained from China and Siberia. [The tons herein referred to are probably tons of 2,240 lb.—Editor.]

Potash from Wyoming Lava

Lava in the Leucite Hills, Sweetwater County, Wyo., is composed largely of leucite, a mineral rich in potash. This lava, called wyomingite, is there very abundant, and the total quantity of potash it contains is estimated at 200,000,000 tons, but it has not yet been profitably extracted. In a series of experimental studies of the reactions of various salts on wyomingite under certain conditions, the United States Geological Survey has obtained interesting results as to the extraction of potash, which are published in the Professional Paper 98-D. The paper may prove suggestive to chemists who are studying methods of extraction of potash from igneous rocks. A copy of the report may be obtained free on application.

Process of Imparting to Unfused Tungsten or Molybdenum the properties of the fused metals by correcting the porosity of the unfused metals is effected, according to H. Leiser, by impregnating a sintered and shaped piece of W or Mo with a paste of amorphous or colloidal W or Mo, in vacuo, or by applying the paste by rubbing. If the piece which has been so treated be heated over the point of conversion from the amorphous modification into the crystaline variety, and this operation be repeated often enough, a completely non-porous product is obtained. The unfused W is heated preferably to above 1,300° in order to impart an increased density and hardness to the metal.

The Roasting of Blende*

By Maurice de Lummen

SYNOPSIS—Examination and story of the manner in which different constituents of blende behave toward roasting and their effect on sulphur elimination. A description of the mode of operation of the Hasenclever, Delplace, Hegeler, McDougal and Spirlet furnaces and the particular advantages of each. Brief comments on gases from blende roasting for sulphuric-acid manufacture and relative amounts of acid so produced in England, Germany and Belgium.

Blende, which at the present time is the most important of the zinc minerals, is a sulphide of zinc containing in the pure state 67% zinc and 33% sulphur. In practice the blende which reaches the roasting plant contains from 35 to 55% zinc, and has a sulphur content ranging from 25 to 30%. The zinc sulphide is mixed with varying quantities of the sulphides of lead and iron, as well as with silica (SiO_2), carbonate of lime ($CaCO_3$) and magnesia ($MgCO_3$). Many blendes also contain fluorine (CaF_2) and sulphate of barium ($BaSO_4$).

Sulphide of zinc not being reducible in a practical manner by carbon, it is necessary, in order to be able to extract the metal, to transform the ZnS into the oxide of zinc, whence arises the necessity for as complete roasting as possible. In practice the complete elimination of the sulphur from blendes is not possible, which will be appreciated from an examination of the manner in which the different constituents of blende behave toward roasting.

Sulphide of Zinc—Heated in contact with air, ZnS is transformed into the oxide according to the equation, $ZnS + 3O = ZnO + SO_2$. A portion of the SO_2 liberated by the roasting is oxidized to SO_3, which transforms a certain quantity of the ZnO formed into sulphate of zinc. If the roasting is well conducted, this sulphate is finally decomposed; but if a part of the sulphate remains undecomposed in the roasted blende, losses of zinc are occasioned thereby during reduction.

Sulphide of Lead—The lead sulphide contained in the blende gives place during roasting to the formation of PbO, $PbSO_4$ and SO_2, the quantity of sulphate formed being often very important. If the blende is poor in silica—as lead sulphate is not decomposed by the temperature of the blende furnace—this sulphate will turn up again in large measure in the roasted blende. If, on the contrary, the blende is highly siliceous, as is often the case, the silica will react with the sulphate of lead to form a silicate according to the equation,

$$PbSO_4 + SiO_2 = PbSiO_3 + SO_3$$

Silica then exercises a favorable effect upon the desulphurization of the ore.

Sulphide of Iron—This is altered by the roasting to ferric oxide (Fe_2O_3). Some ferrous and ferric sulphates ($FeSO_4$ and $Fe_2(SO_4)_3$) may be formed at the commencement of the process, but they are easily decomposed to ferric oxide before the blende leaves the furnace, as the decomposition of sulphate of iron takes place at about 700° C., a temperature lower than that of the furnace.

Carbonate of Lime—Under the action of the heat and of the acid atmosphere existing in the interior of the furnace, the lime is largely transformed to sulphate of calcium ($CaSO_4$). The sulphate formed may react with the silica to give different silicates according to the quantities of SiO_2 and sulphate present, but the action of SiO_2 on calcium sulphate only commences at a temperature of at least 1,000° C. The sulphate of lime may equally react with the ferric oxide (Fe_2O_3), according to the equation,

$$CaSO_4 + Fe_2O_3 = CaOFe_2O_3 + SO_2 + O$$

but this reaction only commences at 1,100° C. As temperatures of 1,000° and 1,100° C. are not always reached in blende furnaces, and as sulphate of lime only commences to decompose under the influence of heat at 1,200° C., it is seen that the greater part of the sulphate of calcium formed during roasting will be met with again in the roasted blende.

Carbonate of Magnesia—As with lime, the greatest portion of the magnesium is changed to the form of sulphate ($MgSO_4$). Sulphate of magnesium is less stable than the calcium salt, and a part is decomposed in the hottest regions of the furnace; but nevertheless the sulphur combined with magnesium in the raw blende is to be regarded as nonutilizable.

Sulphate of Barium—This is met with in certain blendes in noticeable quantities. It is only decomposed by a temperature bordering on 1,500° C., and although silica and ferric oxide may react with it, their action only commences at 1,000° C. Sulphate of barium will therefore be found again in the roasted blende.

Fluorine—Fluorine is a constituent of many blendes. During roasting CaF_2 is decomposed under the action of the heat and acid atmosphere, the fluorine being evolved partly as silicium fluoride (SiF_4) and partly as hydrofluoric acid (HF). This acid energetically attacks the packing of Glover towers so that often these need renewing after a year. When blendes containing fluorine are burnt, the precaution should be taken to have a Glover in reserve.

The foregoing analysis of the manner in which the principal constituents of blendes behave toward roasting shows that if the process is well carried out, the roasted blende will only contain the sulphur combined with lead, calcium, magnesium and barium. This amount of sulphur is that referred to as nonexpellable.

In practice there is always a certain quantity of sulphur in excess, depending on the quality of the ore, more or less on the care taken over the roasting, and also on the kind of furnace employed. The majority of roasted blendes contain a certain percentage of sulphate of zinc. We have seen that there is always the formation of $ZnSO_4$ during roasting by reason of a reaction between the ZnO formed and SO_3. It is determined that $ZnSO_4$ heated in a current of air decomposes at a temperature in the neighborhood of 770° C.—that is to say at a temperature that is exceeded in every blende furnace. The experiments of Landis and Hofman show that if the

*Reprinted from "Chemical Trade Journal and Chemical Engineer," Mar. 18, 1916. The footnotes are by the editor of "Eng. and Min. Journ."

blende in the furnace is not constantly submitted to the influence of a current of fresh air, there is established an equilibrium system, $ZnO - SO_2 - O - ZnSO_4$, which may persist up to very high temperatures.

The practical conclusion to be drawn from this is that the blende must be stirred as much as possible in order to bring each particle in contact with fresh air, and that this air must be continually renewed in order to carry off the products of the dissociation of $ZnSO_4$. If blende is roasted in a furnace in which these conditions can be fulfilled, it should not contain any $ZnSO_4$, or at most an exceedingly small quantity.

What has just been said applies particularly to the final period of the roasting—that is to say, to the last hours during which the blende remains in the furnace.

The commencement of the roasting of blende presents no difficulties. After the blende is lighted, a regular and frequent stirring is necessary. If the blende, once lit, is not raked regularly, the upper layer alone is desulphurized and forms a crust, impeding contact of the air with the lower particles, and consequently oxidation. This is because with blende there is no catalytic action like that due to the presence of Fe_2O_3 during the roasting of pyrites.

The conditions necessary for obtaining a well-roasted blende at the same time as sulphurous gases suitable for good working of the lead chambers may then be summarized as follows: (a) Regular raking of the blende as soon as it is ignited, in order to renew the layer in contact with air, and thus permit of the combustion of the greater part of the sulphur; (b) toward the end of the roasting, the remaining sulphur, as well as the $ZnSO_4$, must be eliminated by frequent raking in a current of fresh air, the blende being maintained at a temperature of from 800° to 850° C.

These requirements, and especially the latter, imply the employment of furnaces with relatively low roasting compartments, so as to make good use of the air introduced, the furnace being, moreover, arranged for preheating the air introduced.

Types of Blende Furnaces

Generally speaking, one may say that the whole of the blende roasted is treated in furnaces belonging to three well-characterized types—Hasenclever (Rhenania), Delplace and Hegeler. The first two are hand-operated furnaces and are almost exclusively employed in Europe; the third is a mechanical furnace in general use in the United States.

These three furnaces are muffle furnaces, so as to permit of the transformation of the sulphurous gases evolved during roasting into sulphuric acid. For many years the Hasenclever furnace, despite all its defects, was considered as being the only one permitting of roasting blende for producing H_2SO_4. It was only toward 1888 that Delplace constructed his first furnace, which deserved an enormous success owing to its ingenious arrangement, the good roasting which it permitted and above all, its small fuel consumption. To this last point was attached considerable importance by European manufacturers, the latter not then having difficulties as regards labor. In the United States the conditions are reversed, labor being scarce and dear and coal cheap, wherefore the need for mechanical furnaces even as far from perfection as the Hegeler type.

The Hasenclever furnace is sufficiently known not to need description. Let me say merely that it unites all the disadvantages that a blende furnace could possess. It consists of three muffles of a slightly less length than that of the furnace, which is about 35 ft. The blende must be pushed from one end to the other of each muffle by means of very large paddles and by a movement recalling that of an oar. This makes the worker's task difficult. The working doors are necessarily very large, so that when the furnace is operated a considerable excess of air enters, cooling the blende and diluting the gas going to the Glover. The interior height of the roasting compartments between base and arch is relatively great, leading to bad utilization of air. From the cooling that takes place each time the doors are opened, it follows that an intense heat is required to bring the furnace to the temperature necessary for the reactions. This applies, above all, to the lowest hearth, where by reason of the little sulphur remaining in the blende, the heat due to the combustion of sulphur is insignificant. The consequence is that the consumption of fuel is very high—at least 20 to 25%. The working of the furnace being difficult, the output of the laborer is not good and does not exceed 800 or 900 kg. of blende.

The characteristics of the Hasenclever furnace are, then: (1) Difficult working and bad field of the operator; (2) very high roasting compartments, giving bad use of air and gases poor in SO_2; (3) large working doors, giving entrance to an excess of cold air and hindering the frequent raking of the blende in the lower position by reason of its rapid cooling; (4) high fuel consumption.

The Delplace Furnace

The Delplace furnace is composed of a series of units similar to those of a Maletra furnace and is furnished with grates heating the lower shelf of each unit, the flames from the grates circulating under the lower hearth. The working of the furnace is the same as that of an ordinary Maletra furnace, the raw blende being charged upon the upper hearth and remaining a certain number of hours on each of the hearths from top to bottom. The battery of Delplace furnaces is generally composed of 9, 12 or 15 units, each burning about 1,000 kg. of blende per 24 hr. Each group of three units is furnished with two fireplaces, each of which has a muffle heated by the heat radiated from the fire and into which the coal is charged. In this muffle the coal distills, giving up its volatile matter and forming coke. When the evolution of volatile matter is completed, the coke is pushed onto the fireplace, where it burns. Air heated by the waste heat of the burners is brought by canals led in several directions to burn the gases liberated by the coal. This permits of distributing the heat in a very regular manner.

The air used for the combustion of the sulphur in the blende is also strongly heated before being introduced into the furnace. This disposition of the burners, together with the recovery of the waste heat, enables the blende to be roasted with an extremely reduced quantity of fuel, several works employing this furnace having a consumption of fuel of 10% of the weight of the raw blende charged.

The height of the roasting compartments of the furnace—that is to say, the distance between the upper side of one slab and the lower side of the following one—is

6½ in. The operating doors on each shelf are very small and exactly proportioned to enable the introduction of the shaft of a rake, the section being about 12x1½ in. All this has, as a result, a great concentration of heat as well as good utilization of the air introduced into the furnace. Sulphurous gases are obtained containing on an average 6.5 to 7% of SO_2. This it is impossible to attain with any other type of blende furnace. The fact that the operating doors are very small permits of working the furnace without the latter cooling in any noteworthy manner.

Operating is the same as with a Maletra furnace. Each unit is worked with four or six hours' interval. The laborer begins by emptying the lower hearth containing blende that has been completely roasted, then bringing down successively one hearth the contents of the furnace. The uppermost hearth emptied, he charges it with from 180 to 250 lb. of raw blende. Every hour or every two hours during the four or six hours' interval between the working of a unit, the operator rakes each hearth of that unit so as to stir the blende and renew the layer on top. It is easy to appreciate the advantage of this method of working. The operator works in a compartment of restricted dimensions, and has only to stir a minimum quantity of blende, which gives easy labor and a yield higher than with the Hasenclever furnace. The yield per operator with the Delplace furnace varies from 1,000 to 1,200 kg. Each time that the furnace is operated in order to lower the blende from one hearth to another, the ore is vigorously stirred and brought into contact with the air. This also takes place when the operator rakes over the charge. The furnaces being back to back, a compartment is always worked at the same time as the corresponding compartment of the opposite side. The blende which falls from the front is piled on the immediate lower hearth of the rear. By this method of working the operators mutually control one another.

The Delplace furnace thus possesses the following points: (1) Easy working and good yield; (2) low roasting compartments giving (a) gases rich in SO_2 (7%), (b) concentration of heat favorable to roasting; (3) small operating doors, enabling frequent stirring without cooling the furnace; (4) heating of the air introduced into the furnace; (5) low fuel consumption.

The Hegeler Furnace

The Hegeler furnace, which is mechanical, is employed in the United States by all the zinc smelters who transform the sulphurous gases of roasting into sulphuric acid. Introduced in 1882, it has scarcely been modified since. The furnace has two compartments about 75 ft. long. Each compartment has seven hearths, the lowest two being fitted with muffles for the heating. The movement of the blende across the furnace is carried out by means of rabble arms dragged by a chain. The rake enters at one end of a shelf and leaves at the opposite; then, after being cooled by the air, enters the furnace again. Each shelf is fitted at its two extremities with movable doors, permitting the entry and exit of the rakes. The height of the shelves is relatively great (about 2 ft.), which makes a defective use of the air and gives gases very poor in SO_2 (3 to 4½%). The blende is stirred at intervals varying from 1½ to 2 hr., which is little for a mechanical furnace. The capacity of a Hegeler furnace is about 40 tons of blende per 24 hr.; but although the furnace is mechanical, the number of workers varies from 13 to 15. The consumption of coal is very high (25% of the weight of the raw ore charged). The necessary power is about 40 hp.

In view of its dimensions a Hegeler furnace cannot be constructed in an existing building. If one adds that, the cost of the furnace is about $60,000, it will be seen that if the use of this apparatus is possible in America, it will not be so in Europe. Besides the disadvantages of having an imperfectly roasted ore, the gases very poor in SO_2, the cost of roasting a ton of ore is the same as with a Hasenclever furnace and is much higher than with a Delplace.[1]

The McDougal Furnace

For the last decade European manufacturers have been aware of the interest that a good mechanical furnace for the roasting of blende would present, and numerous systems have been proposed and tried. Most of the trials have been with a view to adapting to the roasting of blende furnaces the McDougal type—trials which have established that this kind of furnace is not suitable. As soon as they have a diameter scarcely great enough for obtaining a suitable production, the height of the roasting compartments becomes too great for good use of the air. Moreover, if the diameter of the furnace did not require a considerable rise in the arches, it would nevertheless be necessary to have a sensible distance between two consecutive ones in order to replace, if required, a broken arm. Another point to the disadvantage of the McDougal-type furnace is that it generally produces much dust. If this is not of capital importance in roasting pyrites, it becomes so in roasting blende, having regard to the value of the zinc. In addition, any furnace employing cast-iron rabble arms must have them strongly cooled with either air or water circulation. This, then, involves on the one hand carrying off the heat units from the furnace, while on the other supplying them by burning coal in the fires.[2]

The Spirlet Furnace

The only mechanical furnace tried in late years and not having these inconveniences is that invented by a Belgian engineer, X. de Spirlet. The principle of the furnace is original and entirely distinct from what has previously been essayed. The characteristic of the apparatus is that it has no metallic portion in the interior of the furnace. This is composed of a certain number of platforms of fire-clay material superposed and alternatively fixed and movable. The fixed ones are carried on six columns arranged round the furnace, the movable ones turning about an imaginary vertical axis. They are fitted with rollers and move on a rail carried by columns. Into the interior face of each arch are built a certain number of fire-clay bricks arranged like teeth and displacing the blende toward either the interior or the exterior. The space between two consecutive plates forms a shelf of the furnace and is closed by a sand joint.

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[1]Hegeler furnaces are now being built with hearth lengths up to 60 ft. and roast as much as 50 tons of ore per 24 hr. (input). Such furnaces can hardly be built at as low as $60,000, certainly not nowadays. Formerly $75,000 was a rough estimate for the furnace alone.

[2]Mr. de Lummen does not mention the Merton furnace, which may be considered a combination of the reverberatory and McDougal type and has found some successful use among zinc smelters, it is said, though but little reliable data on this subject are available.

Generally the furnace comprises three shelves, the lowest alone being heated. The advantages of such a construction are apparent. From suppressing the metallic arms, the height of the shelves is very slight—hardly greater than that of the shelves of the Delplace furnaces. The consumption of coal is small, never exceeding 10%. As the shelves are low, the production of dust is not important. The weak point of the furnace is evidently the employment of teeth of fire-clay material, which would necessitate the stoppage of the furnace when the number broken became too great.[3]

Several attempts have been made to roast blende in rotary trommels like modern cement kilns. These attempts have never brought anything but disappointments to those who have made them. Besides the great difficulty of constructing such muffle furnaces, the utilization of the air is as bad as possible, giving gases containing a very feeble percentage of SO_2. Moreover, the roasting is defective. As far as Europe is concerned, one can say that up to the present no mechanical furnace has been definitely adopted for the roasting of blende.

Sulphuric Acid

The utilization of the gases from the roasting of blende and the method of transforming them into sulphuric acid are the same as for the gases produced by the roasting of pyrites. As the SO_2 content of the gases from blende furnaces is not always so high as that of pyrites gases, for the same acid output a somewhat larger chamber space must be counted on if blende is burnt. As most blendes contain fluorine, the life of the Glovers is generally quite short enough, whatever the quality of the packing employed. Usually after 12 or 18 months' working the packing of the Glover must be replaced, so that one must always be kept in reserve.

The consumption of nitrate is practically the same as with pyrites, excepting always if furnaces giving gases poor in SO_2 are used.

As regards the life of the lead chambers, this is practically the same as with pyrites. Many Continental and American zinc works employ the contact process in connection with their blende furnaces, the system most in favor seeming to be that of Grillo-Schroeder. It was at the zinc works of Grillo that Dr. Schroeder invented and tried his contact process. Operation is not more difficult than with pyrites, except that more precautions must be taken in washing the gases before putting them in contact with the platinum, on account of the regular presence of silicon tetrafluoride in the sulphurous gases from blende furnaces.

England producing little zinc, the quantity of sulphuric acid made from blende is insignificant in comparison with that produced from pyrites or spent oxide. In Germany the quantity of acid produced from blende does not differ sensibly from that produced from pyrites. In Belgium, on the other hand, 65% of the total production of sulphuric acid was made from blende, explainable by the fact that Belgium produced annually nearly 200,000 tons of zinc, representing a quantity of blende to be desulphurized of about 450,000 tons. So considerable a production would be possible only with difficulty if the Belgian zinc works were obliged themselves to desulphurize all the blende treated in the zinc furnaces. That is why these works have working arrangements with the acid works more or less in the vicinity. These latter receive the raw blende, extract the sulphur, and then return the roasted blende to the zinc works. The roasting works receive the sulphur gratuitously, and also what is called a "roasting bounty"—that is to say, for each ton of blende roasted they receive a fixed sum, which ten years ago reached 10 or 12 francs. In later years this bonus has declined to 5 francs and even less, the works having more demands from acid makers than they have blende to be desulphurized. This desire on the part of the acid makers to roast blende, due to the sensible difference in the cost price of the acid, has been developed since the introduction of the Delplace furnace, which may be employed at choice either for blende or pyrites, the fires being extinguished in the latter case.

[3]The Spirlet furnace, which was described in "Eng. and Min. Journ., of Oct. 3, 1914, is reported to be in successful use at the works at Overpelt and Lommel in Belgium. Furnaces of this design have lately been tried experimentally at Argentine, Kan., and Cleveland, Ohio, and a rather large number of them are now being erected in the United States.

Chronology of Mining for May, 1916

May 1—United Zinc Smelting Corp. began business.—Tamarack & Custer paid initial dividend.—New Mexican mining law promulgated in a decree issued by Carranza.—Inspiration paid initial dividend.

May 2—Work resumed at Ophir mine, Butte district.

May 3—Silver price crossed 75c. for first time since 1893.

May 4—Wage increase announced by leading mining companies in southeast Missouri district.

May 6—Marigold No. 5 dredge, Yuba County, California, started digging.—Increase in wages announced by most Cobalt companies.

May 8—Strike of shovelers in Flat River district.—Algomah paid initial dividend.

May 9—Ore-carrying steamer "S. R. Kirby" broke in two and sank in Lake Superior; overloading given as cause.

May 17—Furnace A of Colorado Fuel and Iron Co. blown in.

May 23—Fire in Yellow Jacket shaft, on the Comstock; four men killed.

May 29—Yukon-Alaska Trust declared initial dividend.

Mond-Castner Alkali Merger

Announcement has been made in London of an important heavy-chemical combination for the purpose of extending British foreign trade. A working agreement has been arranged between Brunner, Mond & Co. and the Castner-Kellner Alkali Co., providing for an interchange of stock and directors. The combined capital of the two companies represents approximately $40,000,000. The arrangement affords great possibilities for obtaining new trade in the British Empire, much of which formerly went to Germany, and new business is expected in many neutral countries. The new plans are said to involve important economies besides avoiding unnecessary competition in soliciting foreign trade. The business embraces the manufacture of salt, soda, soap, alkali and aluminum products. Brunner-Mond & Co. recently acquired control of the Ammonia Soda Co.

Portable Mining Equipment for Prospects

By Louis A. Rehfuss and W. Clifford Rehfuss*

SYNOPSIS—A description of gasoline-driven units used in developing a prospect that had outgrown the stage of handwork. Suitable, with slight modifications, to many other similar problems. Vertical 16-hp. gasoline engine and vertical belt-driven duplex air compressor capable of running one hammer drill chosen. Drill-column air hoist substituted for windlass.

To a considerable extent the needs of the small mine have been neglected in mining literature. The profound disputations of efficiency experts, the ambitious plans for operating at the lowest cost the occasional large orebody, have become the obsession of mining writers until today the thousands of small operators seem neglected, despite the fact that there are ten small mines and prospects operating for every mine of size sufficient to render the more ambitious articles necessary. For that reason this article has been written to describe the type of plant we are using today in developing a prospect that has outgrown the earliest stage of handwork, and which we believe, with some slight changes, would be found suitable for the purposes of hundreds of small operators where circumstances make imperative the use of machinery but the lack of developed orebodies prohibits an investment in the more common forms of mining machinery. Suffice it to say that the outfit described permits drilling, hoisting and pumping by machinery, and yet, when dismantled, it will not in the aggregate weigh over three tons, inclusive of engine, compressor, hoist, pump, drills, etc., making it an ideal equipment for prospecting in out-of-the-way places or for developing prospects already found. The extreme ease of installation is another commendable feature, requiring as it does but the lightest of foundations, making it possible to give a prospect a trial for a short time and then pack up and move elsewhere.

Advantages of Gasoline-Power Outfit

Operating in the East Belt of California in the granodiorite area that surrounds West Point in Calaveras County, we found that progress below the surface-altered zone would be extremely slow unless some form of machine drill was provided. Hitherto, here in West Point 3 to 4 ft. of hand-drill hole per shift was about the average in the unaltered granite. The prospect we were opening up was not sufficiently developed to install more than a light, portable outfit that could be moved elsewhere should further work fail to disclose satisfactory results. These factors were paramount in influencing us in obtaining the outfit we have at present.

As water power at the prospect was available only about five months of the year, the sources to be considered were steam and gasoline. Hitherto most of the mines in this vicinity had been installing boilers and firing them with the abundant wood supplies of this timbered country. Even at that they were paying $3 to $3.50 a cord for wood laid down at the mine and were burning two cords per shift to secure 30 or 40 hp., aside from the wage item of the attendant. We concluded that some form of gasoline engine would not only be far lighter and more portable, but also much cheaper to operate. This conclusion has been borne out by experience, as the fuel expense is far less even in this wooded country where gasoline must be hauled 30 mi. from the railroad on an upgrade; and further, when your gas engine is once adjusted the services of an attendant are unecessary, leaving all hands free to attend to other duties in or around the mine.

There are many excellent oil and gasoline engines on the market, but most oil engines are of stationary type and consequently too heavy for ready portability. Moreover, in a country like this, where the freight item alone amounts to 8c. per gal., the difference in cost of the various oils laid down is not great enough to decide against gasoline, which permits the use of a lighter engine.

We found in the vertical type of gasoline engine the power unit best suited for our purposes. Our Clay 16-18-

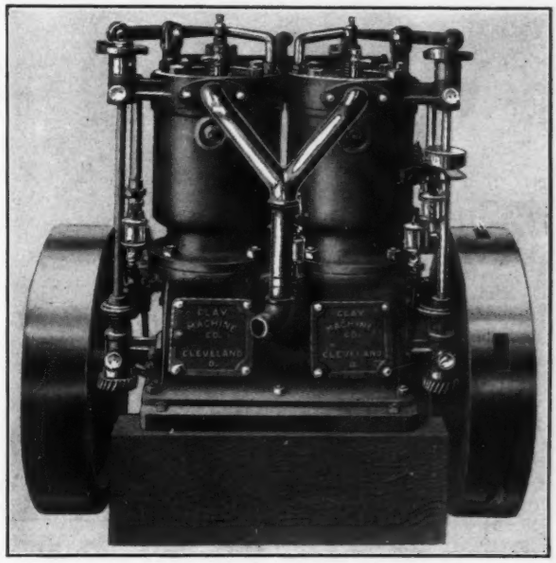


FIG. 1. CLAY 16-HP. GASOLINE ENGINE

hp. marine engine (Fig. 1), equipped for stationary use with two flywheels and a governor, weighs 1,800 lb. and is amply heavy for reliability and light enough for portability. To illustrate the case of installation for engine and compressor, we laid down two logs 12 ft. long and 12 in. thick; two 6x6 crosspieces were mortised into the logs near one end, to provide a bed for the engine; bolts running through logs, crosspieces and engine base tied the whole together. The compressor, which is belt-driven, was mounted in a like manner near the other end of the logs. This simple and light type of foundation has proved satisfactory, as two years of continuous operation has shown.

The engine is extremely regular and dependable in operation and well-adapted to this class of operation. There are no doubt plenty of other makes equally well-suited, but this one embodied all the factors that we

*West Point, Calaveras County, Calif.

required, and we have never felt regret at the selection. In choosing a compressor, the same factor of lightness had to enter into the situation, and we found what we wanted in the Gardner-Rix duplex vertical belt-driven compressor, which is designed to run at from 225 to 400 r.p.m. In selecting the size, we looked for a compressor that would be sufficient to run one hammer-type air drill and so picked out the 6x6 size with a capacity of from 45 to 80 cu.ft. of free air per minute.

It will be seen by reference to Fig. 2 what a compact unit this compressor makes when belted to the engine in Fig. 1. The engine develops its power at just the proper speed for the compressor, so that it may be belted direct without any alterations of the pulleys furnished. The compressor is equipped with light steel disk valves because of its high speed. Its operation has been entirely satisfactory during the two and a half years that it has been in operation, and in that time the total repair expense was only $2 or $3 for two of the light steel disk valves. This type of valve has been so successful that many of the larger compressor companies are equipping their machines with them. As the total weight of compressor and flywheel was only 1,500 lb. it fitted in well

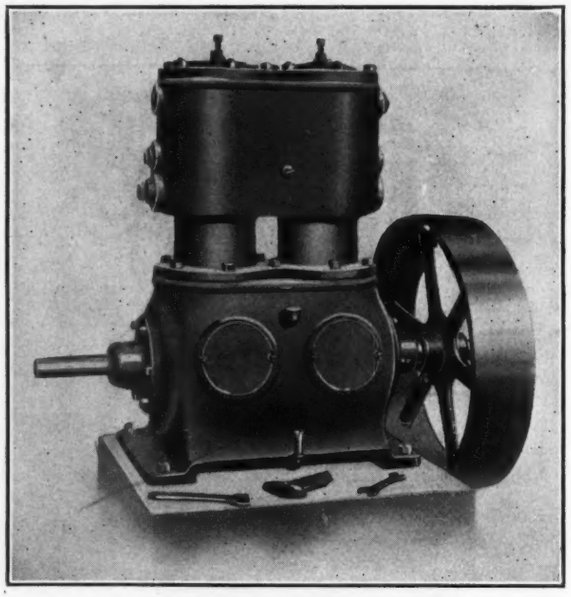


FIG. 2. GARDNER-RIX VERTICAL DUPLEX AIR COMPRESSOR

with the rest of the outfit. An automatic unloader on the compressor permits it to run on a vacuum at full pressure, relieving the load on the engine when the drill or hoist is temporarily stopped.

Since our acquisition of these power units two years ago, several direct oil-driven compressors have come on the market in small sizes well-suited for prospects and put out by the larger firms—one of 66 cu.ft. capacity weighing only 3,000 lb., that can be sectionalized for muleback transportation.

With the small air capacity available in such a plant, it is possible to operate only the hammer type of drills because of the large air consumption of the piston machines. Experiences, however, in this camp of West Point with its hard granite, have demonstrated that the light one-man hammer drills can drill just as fast as the heavier piston machines requiring twice as much air and two men for operation; consequently the cost per foot drilled is much less. There are many types of hammer drill drifters on the market that can be used without a bar in stoping and with a bar in sinking or drifting, making the one drill applicable for all drilling. Examples of such machines are the Waugh "Red Devil" and the Cleveland "Little Miner." As a digression in passing, it may be of interest to note that a Waugh "Red Devil" in the Lockwood mine here at West Point drove 150 ft. of 5x7 drift in solid hard granite in 50 machine shifts with but one man and one machine on a shift. When it is considered that this entailed drilling 50 ft. of hole per shift besides setting up and shooting, all by one man, the performance speaks highly for these hammer drills.

Advent of Mounted Jackhamers

The Ingersoll-Rand Co. now has a mounted jackhamer on the market which is an admirable machine for the several classes of drilling, as it is equipped with the Leyner watering device to lay the dust.

Such machines, which can be used either for stoping, sinking or drifting, probably constitute the most effective single unit for a plant such as we are describing.

Several years ago, however, when we assembled our plant, no "Red Devil" or mounted jackhamer was available, so we procured an Ingersoll butterfly-valve stoper and a jackhamer and have used them for every class of drilling. Our method of drifting with the jackhamer and stoper combined may be seen by references to Figs. 3 and 4. The cut is formed by rows of holes Nos. 1 and 2, the method of drilling these being indicated. We found this the most satisfactory cut we could obtain with the stoper, and it breaks quite well. The holes in rows 2 and 3 are drilled just slightly above horizontal. The lifters can be put in in dry, hard ground with a stoper, but then drilling progress is very slow and the hole has to be cleaned quite often. The lifters may, however, be drilled to greater advantage and with much greater ease by using the jackhamer with the U-shaped wooden trough, as shown in Fig. 4, which illustrates about how hard the machineman has to work when using this system. The handle of the jackhamer slides along the sides of the trough, and by bracing his back against the 3x4 piece of lumber used as a footrest for the stoper, the miner is able to use his feet to keep the machine up against the ground and meanwhile smoke his pipe of peace. These holes must be drilled wet because of the large amount of dust, but a water can is easily adjusted to feed the proper amount of water to the mouth of the hole.

In stoping narrow veins of ore without shooting down any waste, we found it convenient to cut the handle of the stoper in half, thread it and put on an elbow and nipple projecting downward. With this shortened handle we were able to work in stopes only 15 in. wide without taking down any waste rock, as it was possible to use the stoper in any place in which a man could find room for himself. We will admit, however, that it is rather hard work and would not recommend such a procedure for any miner of generous girth.

Our main entrance is through a tunnel, but we found it convenient to install a Leadville drill-column hoist which weighs only 275 lb., without the column, for winzing. It is about the size of two candle boxes placed side by side and is capable of handling a load of 500 lb. at a speed of about 80 ft. per min. operating on compressed air at

90 lb. The air consumption is in the neighborhood of that of a hammer drill, so the compressor plant described above is well able to operate it.

Our experience is that these hoists are about as far ahead of the windlass as the machine drill is ahead of a team of hand drillers, and furthermore, they eliminate

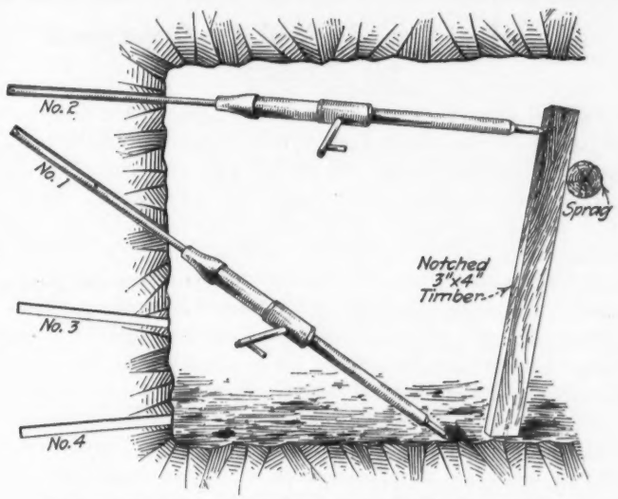


FIG. 3. DRILLING DRIFT ROUND WITH STOPERS

the deadly monotony and wearisome labor inevitable in "windlassing."

In pumping, where the quantity of water is not over 2,000 or 3,000 gal. a day, almost any type of small steam pump will be found to run satisfactorily on the air furnished by this outfit, although freezing is liable to occur and give trouble unless some kind of a trap is used in the air line. We have been using a duplex 4x4x2½ steam pump operating on compressed air, which is of ample size for the requirements of most prospects. Although this pump was designed as a boiler-feed pump, we found

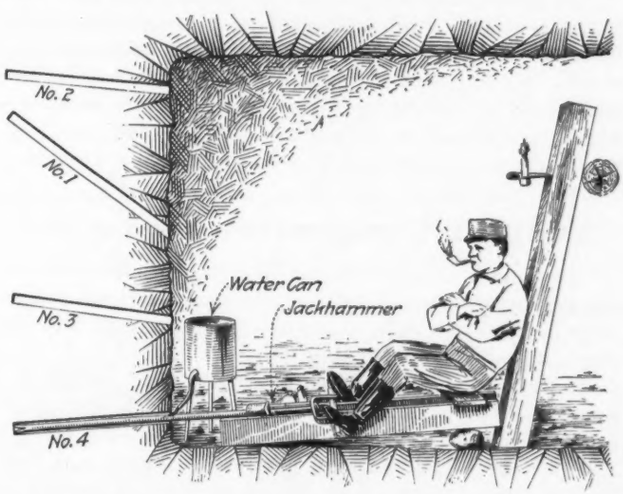


FIG. 4. EASY METHOD OF DRILLING LIFTERS WITH JACKHAMERS

no trouble in sinking with it, the water most of the time being thick and muddy from drillings and the refuse of blasting. A sinking pump that can be hung on a wall plate is the most useful type of course. Pumps run on compressed air require a large amount of air, so that none but a small one can be utilized in this way with the air resources of our outfit. Where the water is especially bad, it is best to make separate provision for its handling such as a jackhead belted to the engine, if such a move is possible.

With the small air capacity available it must not be supposed that the drill, hoist and pump can be kept going at the same time, but by arranging the routine work properly, a considerable amount of work can be accomplished in a limited time by such an outfit as described, with two or three men on each shift. By providing a valve on the air line to the pump by the side of the hoistman, the pump can be operated in the intervals of hoisting.

In conclusion we would say that we seldom use over 7 or 8 gal. of gasoline in a shift, and by buying it in bulk, the expense is very low as compared with the wages of wood choppers.

Tungsten and Tungsten Steel

Not until after the declaration of war did Sheffield steel makers realize how dependent they had been on Germany for their supply of certain alloys, particularly tungsten, says an American consular report. The realization of this condition produced a panic, and prices rose rapidly. To meet this condition, several plants were started for the extraction of tungsten from wolfram ore—one by a combination of 29 firms, of which 27 are situated in Sheffield. This company, known as the High-Speed Alloys (Ltd.), built a plant at Widnes, in Lancashire, from which supplies are now being obtained, and business is being developed as rapidly as possible. In order to control the price of this essential commodity, the government commandeered the supply of wolfram ore in the British colonies and fixed a maximum import price of $13.35 per unit. It also fixed the price for ferrotungsten at $1.38 per lb. of tungsten contained in the alloy and of tungsten powder (96 to 98% pure) at $1.42 per lb. These actions relieved the situation considerably.

As far at least as Great Britain is concerned, Sheffield has a monopoly on high-speed steel. The British government recently fixed maximum prices at which this steel can be sold in the home market. These prices, which have been accepted by the High-Speed Steel Association of Sheffield, are:

For ordinary quality, approximately 14% tungsten, 70c. per lb. (basis); for superior quality, approximately 18% tungsten, 93c. per lb. (basis) net cash, delivered at the customer's works, with the following extras: Rounds and squares, 3 to 8 in. inclusive, 8c. per lb., under ½ in. to ⅛ in., 6c. per lb.; flats, under 1 in. by ⅜ in. to ½ in. by ¼ in., and if in sizes over four times in width over thickness, 6c. per lb.; bevels of approved sizes and sections, 12c. per lb.; bars cut to length, 10% extra; exceptional sizes and sections, not covered in the above list, subject to special quotation.

Although it is admitted that the prices fixed represent a fair profit on the present cost of production, there is no doubt that, as the result of the unprecedented demand for this article, much higher prices can and have been obtained. No announcement has been made, but it is known to the trade that slightly higher prices have been fixed to cover dealings with other countries. Price regulations do not cover dealings with neutral countries.

We have learned from an American tool manufacturer that the question of molybdenum as a substitute for tungsten has been under investigation for several years. In fact, when high-speed steel was first made, some of it was alloyed with molybdenum to give high-speed cutting qualities, either wholly or in conjunction with tungsten, but

such steel has not proved satisfactory for the manufacture of cutting tools of certain classes. It has been used successfully for lathe and planer tools and the like, but molybdenum steel has not been dependable, and some manufacturers have reported a great deal of trouble in the heat treatment.

The situation with regard to tungsten steel has been a great handicap to American manufacturers, but they have met it as best they could. Carbon tools are being very largely substituted. What little tungsten steel there is available necessarily brings the cost of tools abnormally high. Tungsten steel has been selling in the market around $3 a pound base. The very small sizes have been difficult to obtain at any price, owing to the fact that the mills are crowded with carbon business, and they dislike to roll high-speed when it is so very costly, because of the loss they sustain in the operation of drawing. Small sizes have ranged anywhere from $4 to $12 per lb.

Idaho Wage-Payment Law

By A. L. H. Street*

A law enacted at the 1911 session of the Idaho legislature provides that discharge or laying off of an employee shall not terminate his right to wages until all wages due are paid, except that not more than thirty days' wages shall be collectable after such discharge or laying off on account of default in payment. The law gives the same lien to secure payment of this penalty against the employer for nonpayment of accrued wages as is given to secure payment for actual service.

The validity and purposes of this law, as applied to mining companies, was declared recently by the Idaho Supreme Court in the case of Olson vs. Idora Hill Mining Co., 155 Pacific Reporter, 291. Sustaining the validity of the law, the court declares its object to be a proper one—to prevent the privation to which many laborers are subjected if unreasonably delayed in the collection of their earnings, especially after their employment has ceased. It is further held that the law does not penalize an employer for failing to pay an employee's unjust claim for wages nor entitle an employee to claim extra wages when he has by his own conduct prevented the employer from making full settlement at the time of the discharge and demand for payment, nor preclude the employer from interposing any valid counterclaim or defense to the employee's claim.

California Safety-Bear Club

The mine-safety department of the Industrial Accident Commission of California, under the leadership of Edwin Higgins, chief mine inspector, issues monthly "human interest" letters to the miners of California. These are designated Safety-Bear letters and have already secured 3,500 members for the Safety-Bear Club, which has for its object the promotion of safety among mine workers. These letters are issued the middle of each month and contain much of interest to the safety-first movement.

The commission is also issuing bulletins in this connection. Bulletin No. 1, relating to safety and efficiency in mines, takes up the question of accidents due to fall of roof and loose rock and mine fires and gives suggestions for their prevention. A list of illustrations of safety devices on file with the commission is also given. These drawings or the bulletin may be secured free by mine operators in California by applying to Edwin Higgins, 525 Market St., San Francisco, or 423 Union League Building, Los Angeles.

*Attorney at law, 829 Security Building, Minneapolis, Minn.

Alaska Coal Fields Opened to Entry

Official announcement by Secretary Lane of the Interior Department was made June 2 that regulations have been issued under which private individuals and corporations may without further delay begin the leasing and operating of the extensive anthracite and bituminous coal fields of Alaska. Ten years have elapsed since the Alaskan coal fields were withdrawn from private entry and development. The regulations are accompanied by maps and important general information regarding the lands in question. Copies may be secured on application to the Commissioner of the General Land Office.

This announcement means that about 33,370 acres of coal-bearing lands in the Bering River country and about 13,920 acres in the Matanuska section are restored to entry. Small areas in each of the fields have been reserved as required by law, but all the rest of the coal lands are opened to private lease in amounts not exceeding 2,560 acres to any one person or corporation.

Leases will be granted for a period of 50 years. The Government exacts a royalty of 2c. a ton the first five years and 5c. a ton for the succeeding 20 years. After this period of 25 years, it is provided that the royalty shall not exceed 5% of the selling price of the coal. The royalty exacted is considered small but reasonable in view of all the conditions, and was made low for the purpose of encouraging the leasing and also the development of local markets.

The Government's plan is to receive proposals for leases without delay. Preference will be given to those who will make the largest investments and the earliest development of the coal fields for commercial purposes. The form of lease is similar in large part to the private leases obtaining in the West Virginia coal fields and has been passed upon and approved by a board of coal operators.

Freight Congestion Reduced

The freight situation in the East has so improved that the conference formed two months ago, when embargoes were necessary to make it possible to move freight in the East, was dissolved on May 31.

The latest reports showed that the total of loaded cars held by Eastern railroads was 25,000, which was about normal. On Mar. 23, when the conference took charge, it was 61,400, and the total number of loaded cars held by connections for the New Haven on May 19 was 2,137, as compared with 15,213 loaded cars held for the New Haven by connections on midnight of Mar. 16.

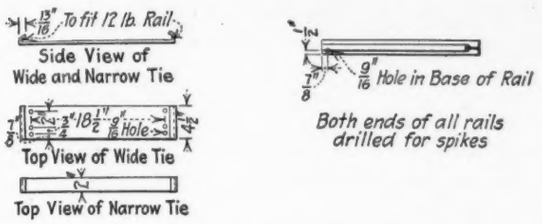
The Tuscumbia Mining and Milling Co., operating in the Bradshaw Mountain District, has struck an ore shoot 50 ft. long by 4 ft. wide that carries silver amounting to $238.68 per ton and 3.8% copper. James H. Sullivan, general manager, formerly of Tonopah, who made the strike within the first three weeks of his employment, regards the find as being significant, since the ore in the Tuscumbia has marked similarities to the ores in the Tonopah district.

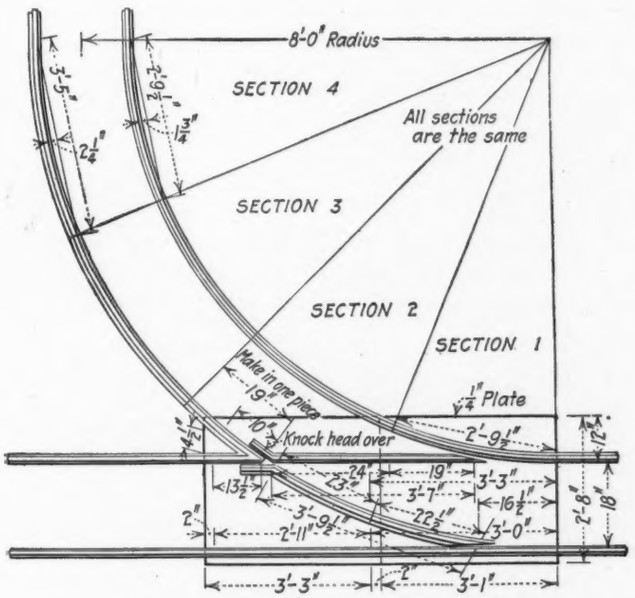
Details of Practical Mining

Standard Sub Turns

By E. W. R. Butcher*

In its endeavor to minimize as much as possible all unnecessary work in mining operations, the Republic Iron and Steel Co. has introduced ready-made turns on its subs. Similar turns may be in use elsewhere, but as far as we know, the old method of fitting each individual turn


To fit 12 lb. Rail
Side View of Wide and Narrow Tie
Hole
Top View of Wide Tie
Top View of Narrow Tie
Hole in Base of Rail
Both ends of all rails drilled for spikes



DETAIL OF STANDARD SUB-TURN

is the one generally in use. This requires considerable work in cutting and bending the rails, entailing a certain amount of loss. The bent rails also persist in accumulating, and eventually a large number have to be straightened out with an attendant waste of steel and time.

When running a new drift, straight sections 10 ft. long are laid as the drift progresses. Wide ties are placed at the joints of the straight as well as the curved sections. The narrow ties are placed between the joints where necessary; as a rule two are sufficient on the 10-ft. sections. The dimensions of these ties, drilling, and drilling of the rails are indicated in the accompanying illustration. The track and plates are held in place by driving spikes through the drilled holes into the regular boards laid on the bottom of the drift or into flat wood ties. The outer of the two adjoining holes in the wide ties is used for adjusting purposes when necessary.

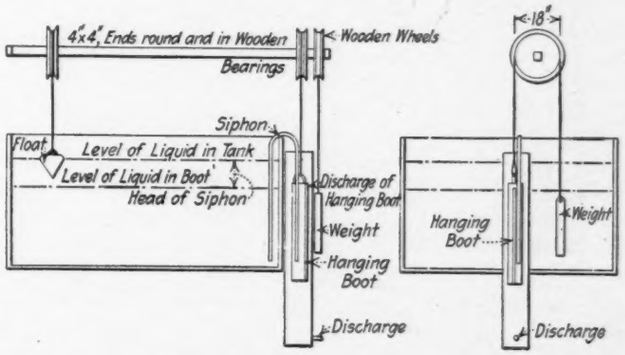
In starting a new drift from the side of another one, a 10-ft. section of straight track is removed and replaced with the two plates indicated in the illustration. Should the plates not come at the desired place, the position can be adjusted by the use of the smaller sections, which are made 2, 4 and 6 ft. in length. Two curved sections complete the turn, from the end of which the straight track is continued. A greater or lesser length of curve can be made by adding sections to or subtracting them from the regular curve.

*Republic Iron and Steel Co., Gilbert, Minn.

Constant-Flow Device

The following description from *Engineering News* portrays a device used by Isaac C. Brewer to give a constant flow of acid on Glover and Gay Lussac towers:

It consists of a 4x4-in. timber, the ends turned round and mounted in wooden bearings above the supply tank. Spiked on this are three wooden wheels—each made of a circle of a 2-in. plank, with a 1-in. circle on each side, nailed with the grain at right angles to that of the 2-in., and forming a rim. From the first of these wheels

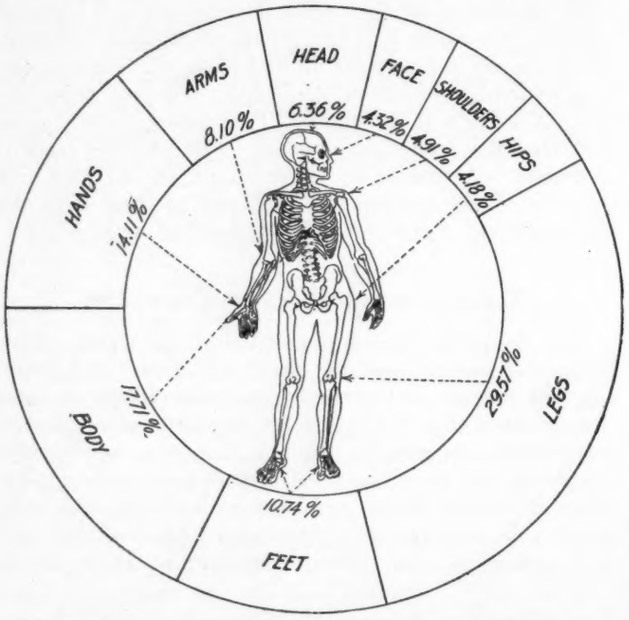


CONSTANT-FLOW SIPHON

hangs a float, resting in the liquid of the supply tank. From the second wheel hangs a boot by means of a chain threaded through the handle. In the end of the chain is a hook which fastens into a link of the chain and enables the boot to be raised or lowered. This boot has a discharge near the top and empties into a discharge box surrounding it, with its opening near the bottom. The third wheel carries a weight balancing the boot and float. A siphon is set with one leg in the liquid of the supply tank and the other in the hanging boot. The head of this siphon, and therefore its flow, is controlled by lowering or raising the hanging boot; and once set, the head and discharge remain constant, for float and boot rise and lower with liquid of the supply tank. For use with acid the tank is lined with lead. A handy man can build and set up this device in a short time and the total expense is small enough to be negligible.

A Body Chart for Non-Fatal Accidents

A body chart, or diagram, showing the percentage of non-fatal accidents to different parts of the body, arranged from a tabulation of 6,719 non-fatal injuries from accidents at coal mines, has been prepared by the Bureau of Mines and is contained in a pamphlet entitled "Coal Mine Fatalities in the United States, 1915," compiled by Albert H. Fay. It will be seen from the illustration that practically 30% of the accidents at coal mines result



PERCENTAGE OF NONFATAL INJURIES RECEIVED BY THE BODY IN MINING ACCIDENTS

in injuries to the legs, and that injuries to the hands amount to 14%, and other parts of the body as shown. This diagram was prepared to aid surgeons and hospitals in selecting the necessary supplies for use at coal-mine hospitals and should be as applicable to metal mining as to the purposes for which it was prepared.

How To Store Cement

It is sometimes thought that only one thing is necessary for the safe and effective storage of cement—a tight roof. Many years' experience has convinced S. P. Baird that water-tight storage is not enough, and he has given, in *Engineering News,* the following requisites for cement storage:

1. Cement will retain its strength for an indefinite period when stored in air-tight containers.

2. Cement will be injured less by storing in paper sacks than in cloth sacks, everything else being equal.

3. Cement in any kind of commercial packages will be injured least while in storage if the packages are piled as closely together as possible. In other words, the outside surface of the pile of sacks should be the smallest amount possible.

4. Piles of cement sacks should be covered with a tarpaulin to prevent as far as possible the circulation of air through the pile.

Note the word "tarpaulin"; an ordinary canvas cover is not a tarpaulin, but a paulin. Five parts coal tar, one part gasoline and one part good japan drier make a water-tight black coating for canvas.

Surface condensation often takes place on a stored sack of cement. The moisture is carried into the cement to its great injury as well as the practical destruction of the sack. The destruction of the sack may not be evidenced at once; but it may be returned to the mill and refilled and sent to some other job, where it bursts and is paid for by a person who was in no way responsible for its condition.

There is a saying among cement men that if you turn your cement—that is, move it from one pile to another—once a month, it will not be injured by an indefinite period of storage. This is not the case; pile it closely and cover it as nearly air-tight as possible and you will have very little caked cement. If the cement is caked it is better to let it alone until you are ready to use it rather than break the cake, thus presenting fresh cement to the action of the air.

Measuring Concrete Aggregate in Revolving Boxes*

The revolving measuring boxes shown in the accompanying illustration have been successfully used by the Coronet Phosphate Co., of Hillsborough County, Fla., in the construction of a reinforced concrete bin. The yardage did not warrant the construction of sand and stone bins, and the mixing yard consisted of the usual

CONCRETE AGGREGATE MEASURED IN REVOLVING BOXES

loading platform adjacent to the cement shed. The revolving boxes were used in measuring both the sand and the stone, which had to be wheeled up runways to this platform. The cement was measured and discharged directly into the mixer.

The boxes are proportioned in size to hold the exact quantity of each material and are placed on 1¼-in. pipe as axles, with two or more boxes to the stand as desired. The pipe is carried through holes in the 4x4-in. posts, which are braced and carried on a 4x4-in. supports.

A dry batch of 10½ cu.ft. of 1:2:4 mixture was used and required three 2-cu.ft stone boxes, two 1½-cu.ft. sand boxes and one 1½-cu.ft. cement box. The framework was light and could easily be moved into the stone or sand piles or from one job to another. The whole

*H. B. Andrews in "Engineering News," May 25, 1916.

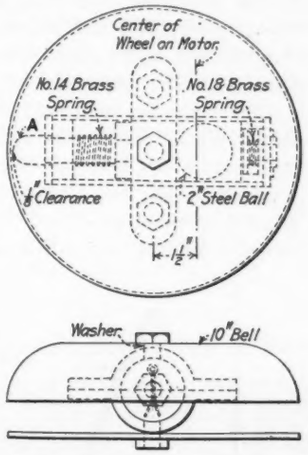
framework is detachable and can be taken down in a few minutes.

The bottoms of the boxes were high enough to allow a wheelbarrow beneath in such a way that the box could be turned on the pipe, discharging the load and righting itself for loading. The apparent objection to this form of loading is in the height of shoveling the material, but by using scoops the boxes were quickly loaded and the additional height was not objectionable. Loading delays were eliminated, and a uniform mixture obtained.

Automatic Locomotive Gong

By A. Cohn*

The motor bell shown in the illustration has proved to be satisfactory in the mines of the Republic Iron and Steel Co., at Gilbert, Minn. It is simple and does not depend on any outside power for its operation. This bell is attached to the wheel of an underground electric locomotive. The revolution of the wheel causes the bell to ring. When the cylinder points downward, the steel ball falls on the plunger *A* and causes it to strike the gong. As the bell turns upward, the ball recoils on its spring, and is ready for the next turn. The rate of travel can be easily determined by the sound of the bell as its frequency and tone depend directly on the speed of the motor. In this way it acts as a safety device. It is the intention of the Republic Iron and Steel Co. to install these bells on all of its underground motors.



AUTOMATIC LOCOMOTIVE GONG

Some Rapid Manufacturing

An example of exceedingly speedy manufacturing is recounted by a pump maker in some recent advertising. The work done is remarkable enough to be interesting to the profession in general.

The Los Angeles office of the Layne & Bowler Co., Kansas City, Mo., was called over the long distance on Dec. 27, setting forth the need for pumps for the unwatering of the Mascot mine of the American Zinc, Lead and Smelting Co., in Tennessee. On Dec. 28 the manager of the mining company placed orders for five 16-in. 320-ft. pumps. These pumps were all special, and patterns and castings had to be made, which necessitated working day and night until the last piece of material was ready for shipment. On Jan. 4, eight days after the receipt of the first information that pumps were wanted, the first car was sent out by express, the transportation charges on this particular car being over $2,839. On Jan. 5 the second car was loaded and shipped. This car weighed 20,584 lb., and expressage was $1,883. It happened that these two cars made their trip just a day ahead of a serious washout and arrived at destination without any delay.

Shafting was purchased in the East and worked over in Eastern shops. This material was also shipped by express, running the express bill on the entire shipment well up over $13,000. Telephone and telegraph charges totaled $241. The rush in this matter is explained by the fact that the mining company was losing about $5,000 a day while the mines were shut down.

The manufacturing company sent two special installers to put the pumps together, and they had 50 men at their disposal to do the work. They worked in three shifts of 8 hr. each, the special installation men from the factory working from 18 to 24 hr. each day.

On Jan. 14 the announcement was made that the first pump had been running for 12 hr.; on Jan. 25 the mines were completely unwatered.

In less than 30 days from the time the manufacturing company knew of the existence of the purchaser of these pumps, they had the pumps built, shipped, installed, and the mines completely unwatered and in condition to operate. The occurrence is a good example of what concentrated effort can accomplish and shows what may be done when the necessity arises.

An Interlocking Piston Ring

A piston ring with interlocking joint, as shown, has recently been placed on the market by the Chalsmith Sales Corporation, 2 Columbus Circle, New York City, and is made in the usual variety of sizes. These rings are made of gray iron cast singly. The skin of the iron is left on the inside, to insure resiliency. The joint is machined to close limits and is practically gas-tight. It can open from $\frac{3}{16}$ to $\frac{1}{4}$ in., according to the size of the ring, before there is passage for the gas.

A PISTON RING WITH INTERLOCKING JOINT

Heat Value of Fuels*

Kind of Fuel	Heat Units per Lb.	Relative Values	Lb. of Water Evaporated per Lb.
Carbon, pure	14,500	1.000	15.00
Hydrogen	62,500	4.280	62.75
Marsh gas	26,415	1.816	26.68
Olefiant gas	21,328	1.466	21.54
Coal, anthracite	14,833	1.020	14.98
Coal, bituminous	14,796	1.017	14.95
Coal, lignite dry	10,150	0.7	10.35
Peat, kiln dried	10,150	0.7	10.25
Peat, air dried	7,650	0.526	7.73
Wood, kiln dried	8,029	0.551	8.10
Wood, air dried	6,385	0.439	6.45
Charcoal	13,500	0.93	14.00
Coke	13,620	0.94	14.00
Petroleum, W. Va	18,300	1.255	18.80
Petroleum, Penn	18,050	1.24	18.60
Petroleum, Ohio	18,450	1.27	19.05
Petroleum, Asia	18,000	1.24	18.60
Petroleum, Europe	18,000	1.24	18.60
Animal fat	9,000	0.65	9.30

*Box 267, Gilbert, Minn.

*"Power," June 6, 1916.

Details of Milling and Smelting

Lightning Protection for Smoke-Stacks

At the annual meeting of the National Fire Protection Association, held at Chicago, May 9-11, the Committee on Signaling Systems submitted suggestions for protection against lightning. These, according to *Power*, May 30, 1916, included the installation for smoke-stacks, taking for example a stack 140 ft. high. The type and weight of conductors and other materials for use on stacks and the details of their installation are matters requiring in many cases expert investigation of the special conditions.

Two ground rods, the minimum number required for stacks of this type, are provided. A band of the conductor encircles the stack near the top, to which the air terminals and ground rods are connected.

The air terminals are spaced about 6 ft. apart around the periphery of the stack top and extend 18 in. above the top. They are of solid material provided with a thread on one end to be screwed into clamp connectors assembled on the band; the other end terminates in a point.

The air terminals are held in an upright position with fasteners set into the bricks as near the top of the stack as possible. The band encircling the stack is provided with fasteners not farther apart than 3 ft., and the ground rods have them at least every 5 ft.

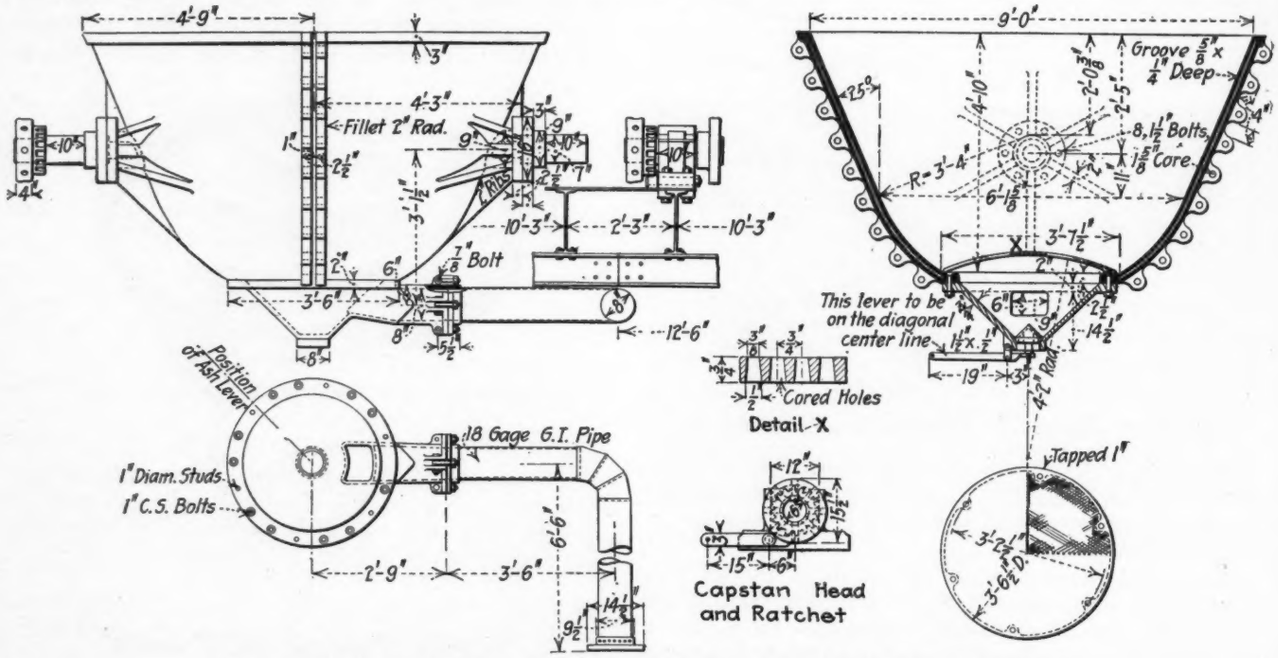
All parts of the equipment which are subject to the corrosive effects of the smoke are protected by a covering of lead not less than $\frac{1}{16}$ in. thick.

The Sintering of Flotation Concentrates

By B. Magnus*

The concentrating ore at Mount Morgan, Queensland, contains about 2% of copper and from 5 to 7 dwt. of gold. About 70% of the latter exists as free gold, but it is in exceedingly fine form. It was found that by grinding the ore fine, much of this free gold was caught in the thick froth of the flotation machine. Although fine-grinding did not materially improve the recovery of copper, the extra gold saved warranted grinding the ore to about 80-mesh.

The resulting concentrates were naturally extremely fine. While there was only a small tonnage of these concentrates to treat, if was possible to get an excellent product from the Dwight-Lloyd sintering machine by mixing concentrates and blast-furnace flue dust in the proportion of 1 : 3. When the percentage of concentrates in the mixture was increased, the sulphur contents rose so much that the Dwight-Lloyd machine neither gave a good product nor did it handle much tonnage, the fine concentrates having a tendency to choke the bed.



DETAILS OF SINTERING POTS USED AT MT. MORGAN WORKS IN QUEENSLAND

With the increase in the production of concentrates, it was necessary to adopt some other means of sintering. Preroasting the concentrate, followed by pot sintering, was undertaken. The preroasting was originally attempted in an Edwards furnace. The product from the Edwards furnace was so fine physically that it was not possible to handle the concentrate either on the Dwight-Lloyd

*Consulting engineer, 61 Broadway, New York.

machine or in the pot-sintering plant. A test made by preroasting in a Godfrey furnace and sintering in a pot proved entirely satisfactory, and a permanent plant with this type of equipment was installed. A matter of interest to metallurgists who may have material of this character to treat is the fact that, in preroasting, the Godfrey roaster gave a product that was coarser than the concentrates sent to it, some agglomeration evidently taking place in the Godfrey furnace.

The preroasted material from the Godfrey furnaces is taken by belt conveyor over a line of 10 sintering pots, 9 ft. in diameter at the top, the details of which are shown in the accompanying illustration. These pots are first charged to a depth of 8 or 10 in., and after this priming has become well ignited, the remainder of the charge is delivered by the conveyor. The blast pressure varies from 4 to 12 oz. and is fed through the usual perforated grate—made of cast steel originally, although at present cast-iron grates are being used owing to the difficulty of obtaining the steel product. The pots hold about 11½ tons of raw material, which is reduced in sintering to about 10 tons. The charge is usually finished in about 14 hr. The pots are tilted by chain blocks and deliver the sintered charge on an inclined floor of rails set in concrete. Side-dumping cars run along a depression beside the concrete-and-steel floor, and roasted material is raked into the cars as required.

Concentrating Quicksilver Ores

An investigation is being conducted by the California State Mining Bureau as to the feasibility of concentrating methods for quicksilver ores. Much experimental work has yet to be done, but sufficient data have been gained to make a preliminary statement of partial results. Quicksilver mining in California has become more and more a question of economically handling larger tonnages of lower-grade ores. Since Robert Scott evolved his fine-ore tile furnace in 1871, there have been no improvements worthy of mention in the metallurgy of quicksilver until the present agitation for concentrating. A surprising feature of the situation is the absolute lack of any systematic sampling and assaying at the quicksilver mines. There is not a quicksilver mine in California known to possess or utilize an assay office. The distillation assay with the "Whitten" apparatus is simple, quick and accurate. The old-timers have been complacently saying, "the furnace gets it all" and that they did not need to assay. It is doubtful if the Scott fine-ore furnaces in operation in California are averaging 75% extraction. In addition much quicksilver is absorbed by the furnace and condenser walls; also soot is formed which has to be re-treated for contained mercury. The products of fuel combustion, being mixed with the vaporized mercury, cause condensing troubles.

Experiments by Walter W. Bradley, of the staff of the Mining Bureau, have shown that high extraction (above 90%) can be obtained by water concentration on tables, with friable ores in which the cinnabar is distinctly crystalline. Crushing by rolls produces a minimum of slimes. If, however, the pulp contains cinnabar slimes, the extraction by tables will be low, but can be improved by classification and treating the different sizes on separate tables. The slimed cinnabar can be recovered by flotation. High extraction has been obtained by flotation tests in finely ground (—80-mesh) fresh ores, utilizing either pine-oil derivatives or eucalyptus oils. "Fresh" ores are specified because, contrary to common conception, cinnabar on exposure does oxidize sufficiently to affect flotation results, as some of these tests have indicated. Good results were obtained by table concentration on an ore carrying natural quicksilver.

The concentrates have to be roasted. Retorts are of limited capacity, and the concentrates because of their high specific gravity require stirring to prevent packing. A small furnace of the Scott type could be used with a narrower shaft and narrow shelf-slit, such as in use at the New Idria mine for treating soot. Some form of rotary roaster may be adapted, or a small-sized unit of the McDougal or Wedge type of mechanically rabbled furnace, muffle-fired.

The ultimate decision between a straight furnace reduction or concentration and roasting of concentrates will be a matter of comparative costs coupled with comparative extractions. The initial installation of a Scott fine-ore furnace unit is high (including condensers, etc., $1,000 per ton per day capacity.) The extraction is low (in the majority of cases probably less than 75%), and the cost of operation is low—50c. to 75c. per ton for large units, economically managed, though this does not include repairs, interest or depreciation on the high initial installation capital. A concentrating plant of equal capacity will require less than one-tenth the initial capital expenditure and a correspondingly lower depreciation charge. It will give 25% to 30% higher extraction, but the operating cost, on account of finer crushing, will be 30% to 50% higher.

Segregation in Gold Bullion

In a paper read at the February, 1916, meeting of the A. I. M. E., by James H. Hance, it was pointed out that in sampling such material as cyanide bars by drilling, variations in the assay were frequent owing to segregation in the original material. Drillings taken near the edge of a bar were ordinarily higher than dip samples, while drillings near the center of the top or bottom were generally lower. Usually drillings from the top assay higher than do those from the bottom.

The presence of silver seems to diminish this segregation, probably owing to the solvent properties of silver toward certain base metals such as lead and zinc. This suggests one way partly to overcome the difficulty of assaying cyanide bullion. If to all bars known to contain little or no silver, enough were added to give 90 to 100 points present, a uniform bar after melting could be easily obtained. From the assay of this bar and the silver added, the original fineness could be calculated.

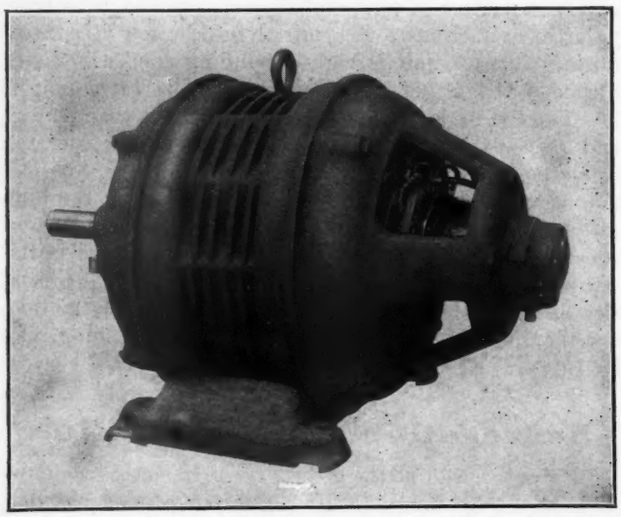
Decrease in the Copper Content of Slag was brought about at the Detroit Copper Mining Co.'s smelting plant, according to the report of V. P. Hastings, superintendent, by not allowing the matte to accumulate in the settlers. The copper in the slag in 1913 was 0.38%, in 1914 0.35% and in 1915 only 0.28.% An average slag analysis for 1915 is given as: SiO_2, 35.3%; FeO, 38.6%; Al_2O_3, 9.5%; CaO, 11.8%; MgO, 1.4%. This slag is slightly higher in lime and lower in iron and silica than in the preceding two years. Other metallurgical improvements at Morenci, Ariz., include the introduction of flotation in the company's concentrator, but owing to interruption of operations in the last quarter of 1915, practically no benefit was derived from this addition. Old tailings, of which there is a considerable accumulation, may eventually be treated by leaching methods.

Mining & Metallurgical Machinery

Induction Motor for Heavy Duty

A new type of motor designed especially for heavy work has been developed by the Westinghouse Electric and Manufacturing Co. It is of the slip-ring induction type and can be furnished in sizes from 1½ to 200 hp. for operation on two- or three-phase 220- or 440-volt 25- and 60-cycle circuits.

The running torque of these motors is the maximum obtainable, and the starting and pull-out torques in all



10-HP. HEAVY-FRAME INDUCTION MOTOR

motors exceed twice full-load torque. They are so constructed that repairs can be quickly made and maximum strength is obtained, while weight and over-all dimensions have been reduced to a minimum.

Manganese Steel

As manganese steel cannot be machined by ordinary methods, says the April, 1916, *Bulletin* of the Taylor-Wharton Iron and Steel Co., it is of the highest importance that accurate information be furnished before castings are made. The shrinkage of manganese steel is greater than that of ordinary steel. A shrinkage of $\frac{5}{16}$ in. per ft. should be allowed in making patterns.

Asbestos Packing Now Made in the United States

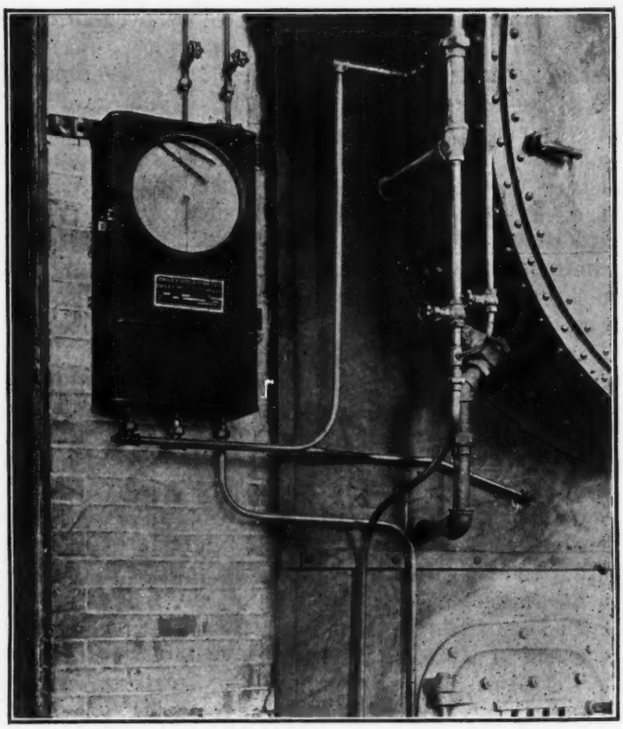
When the foreign-made supply of asbestos packing began to decrease, due to war influence, American manufacturers saw their opportunity to break the strong hold of the foreign manufactures. This was made easier by the fact that 85% of the world's production of asbestos comes from Canada.

The Goodyear Tire and Rubber Co. perfected an asbestos packing known as "Goodyearite," which is made of long, strong fiber combined with those ingredients that are insoluble in steam and oils. This gives a product dependable in every way, which has been subjected to a heat of 750° continuously for two hours without charring. In hydraulic pipe lines, high-pressure steam lines, boiler connections, valves, flanges, oil pipe lines and in service where there is contact with acids, "Goodyearite" has been found proof against deterioration.

New Pipe-Flow Meter

A new recording meter for flow of steam, water, gases and air through pipes has been announced by the Bailey Meter Co., 141 Milk St., Boston. The outfit comprises an orifice plate in the pipe line, with upstream and downstream pipe lines running to a recording differential-pressure gage.

The orifice is the segment of a circle, and the orifice plate is made of $\frac{1}{32}$-in. monel metal, corrugated near its outer edge so as to need no gasket at the pipe connections. The greater pressure is led to the inside of a bell floating in mercury and the lower pressure to a sealed housing chamber. The float walls increase in



BAILEY RECORDING FLOW METER ATTACHED TO BOILER FOR STEAM MEASUREMENT

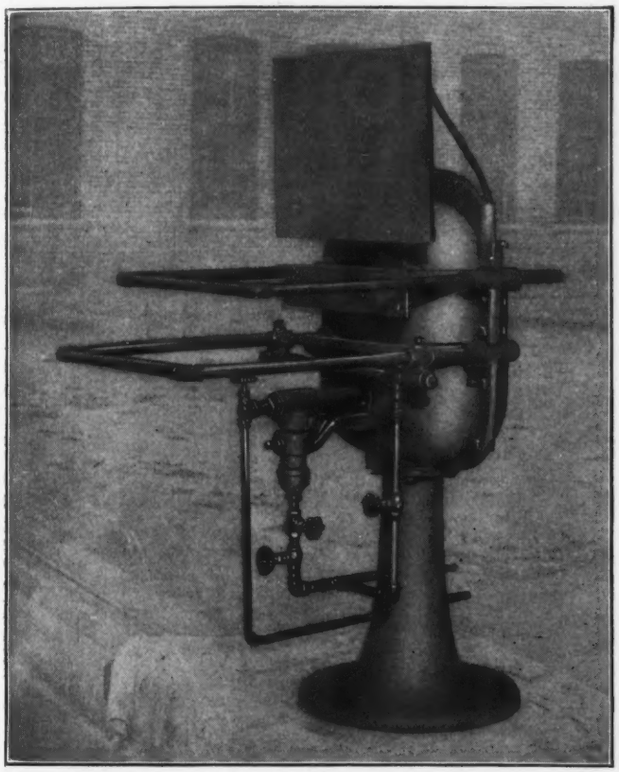
thickness from top to bottom, giving a variable exposed interior cross-sectional area so that the rise and fall are directly proportional to change in pipe flow. This permits a chart with uniform graduations.

An integrator is provided, and there are numerous details of refinement at different points of the meter to

eliminate effects of vibration, prevent spilling or blowing out mercury, etc. The flow meters are also provided, when desired, with standard pen mechanisms for recording pressure and temperature on the flow chart.

Preheating Steel in Leyner Oil-Burning Furnace

An oil-burning furnace extensively used for heating drill steel is now made with a preheating chamber, which greatly increases its capacity. This preheater is a section that fits between the body and cover of the furnace of the old design. It is therefore a simple matter to attach this section to an old furnace by changing a few bolts. The type of burner now furnished with this furnace is suitable



OIL-BURNING FURNACE WITH PREHEATING CHAMBER

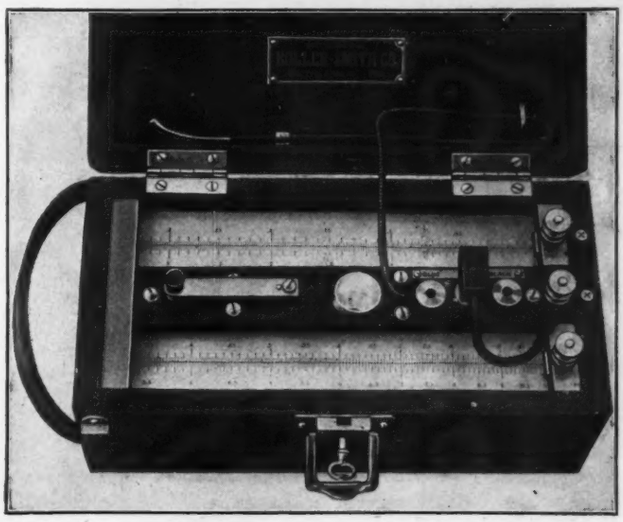
for either high- or low-pressure air. It has merely to be throttled for high pressures, and when this is done, it is as efficient as burners designed especially for high pressures and eliminates the noise common to them. The floor space occupied by the No. 3 Leyner furnace is 3x4 ft. No foundation is required, installation being complete when air- and oil-supply pipes are connected. The manufacturers are the Ingersoll-Rand Co., 11 Broadway, New York.

Direct-Reading Ohmmeter

The direct-reading ohmmeter shown is the latest modified form of the type of portable ohmmeter made by the Roller-Smith Co., 203 Broadway, New York City, and was designed especially for measuring the resistance of relay points in electric signaling systems.

It is in general a slide-wire bridge having self-contained galvanometer of sensitive but rugged design, self-contained dry cells which are conveniently located for renewal, galvanometer key, stylus and self-contained resistances.

The case is of hardwood, highly polished and provided with hinged top, latch and lock and leather handle. There are three ranges—0-1, 0-10 and 0-100 ohms—

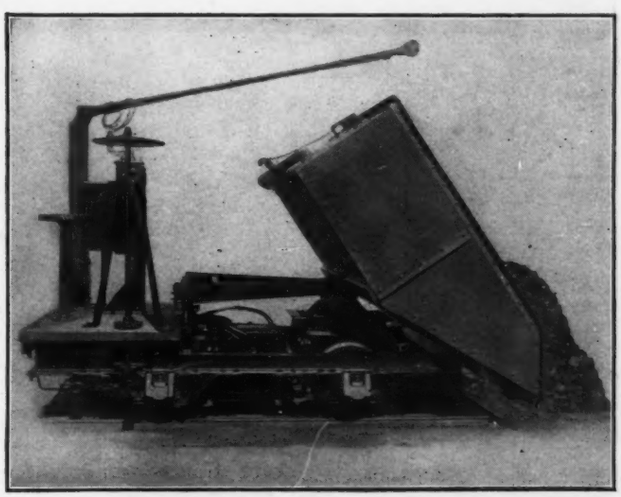


DIRECT-READING OHMMETER

each on a scale 15 in. long, each scale being of a different color—namely, blue, red and black. Means are thus provided for making all relay-point tests as well as many other resistance measurements within the range of the device quickly and readily.

Self-Propelled All-Around Dump Car

A material reduction in the cost of disposing of waste material is accomplished by the use of a motor-driven all-around dump car made by the Orenstein-Arthur Koppel Co. and shown in the accompanying illustration. The



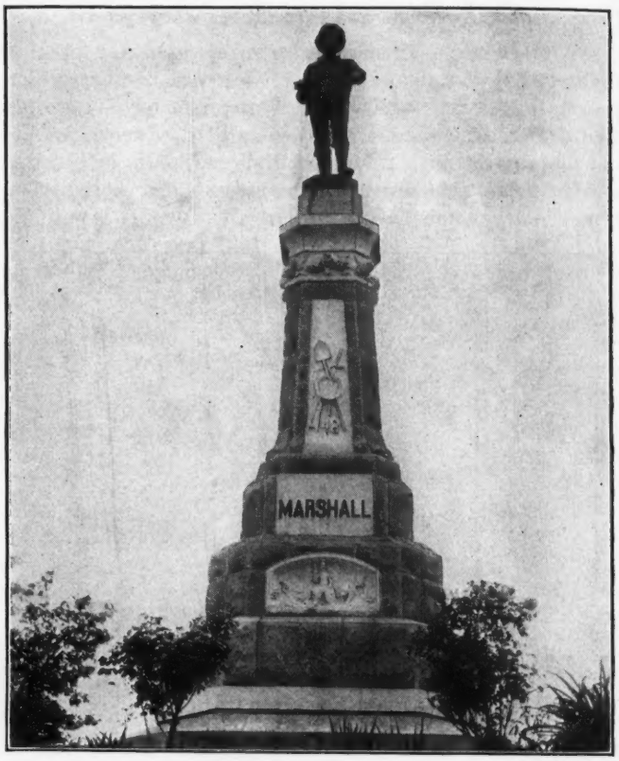
THE CAR DISCHARGING ITS LOAD

car can be handled easily by one man. The dump can be built up to both sides or to the end, as desired. The speed of travel is relatively high, and no special dumping mechanism is needed at the disposal point.

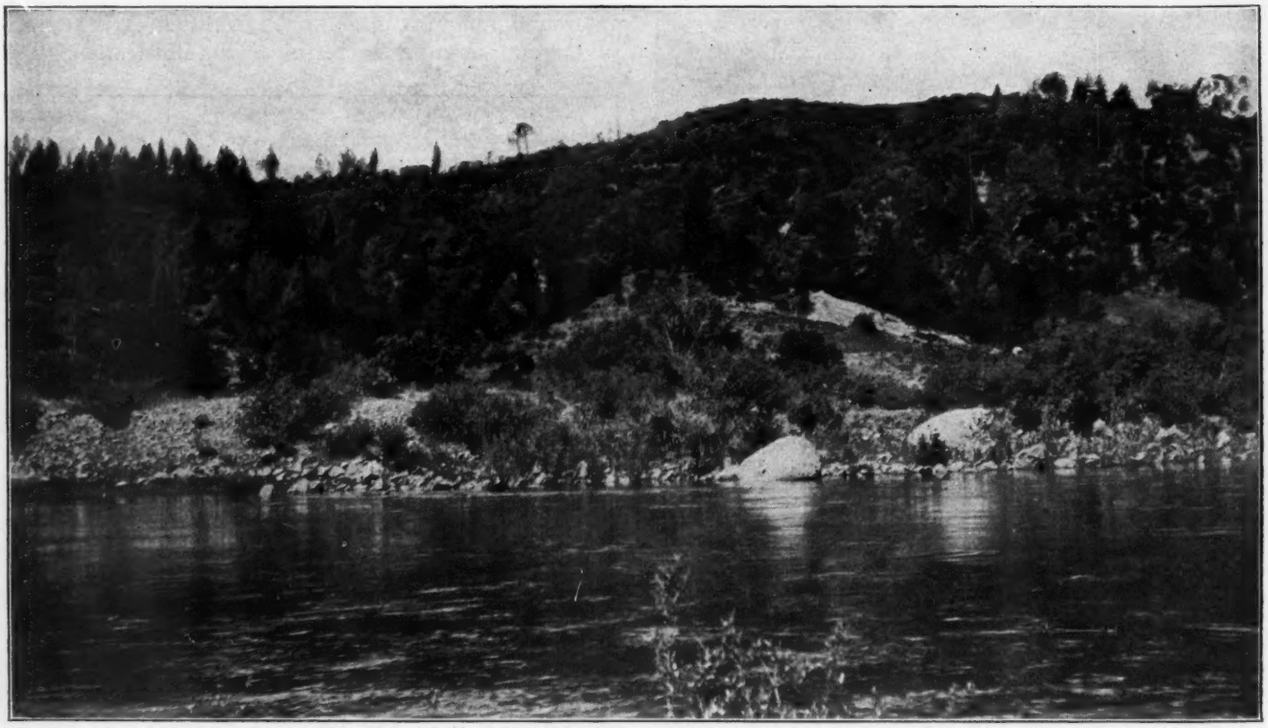
The dimensions of the car are: Length, 9 ft. 8 in.; width, 5 ft. 10 in.; height, 4 ft. 8 in.; capacity, 54 cu.ft.

Photographs from the Field

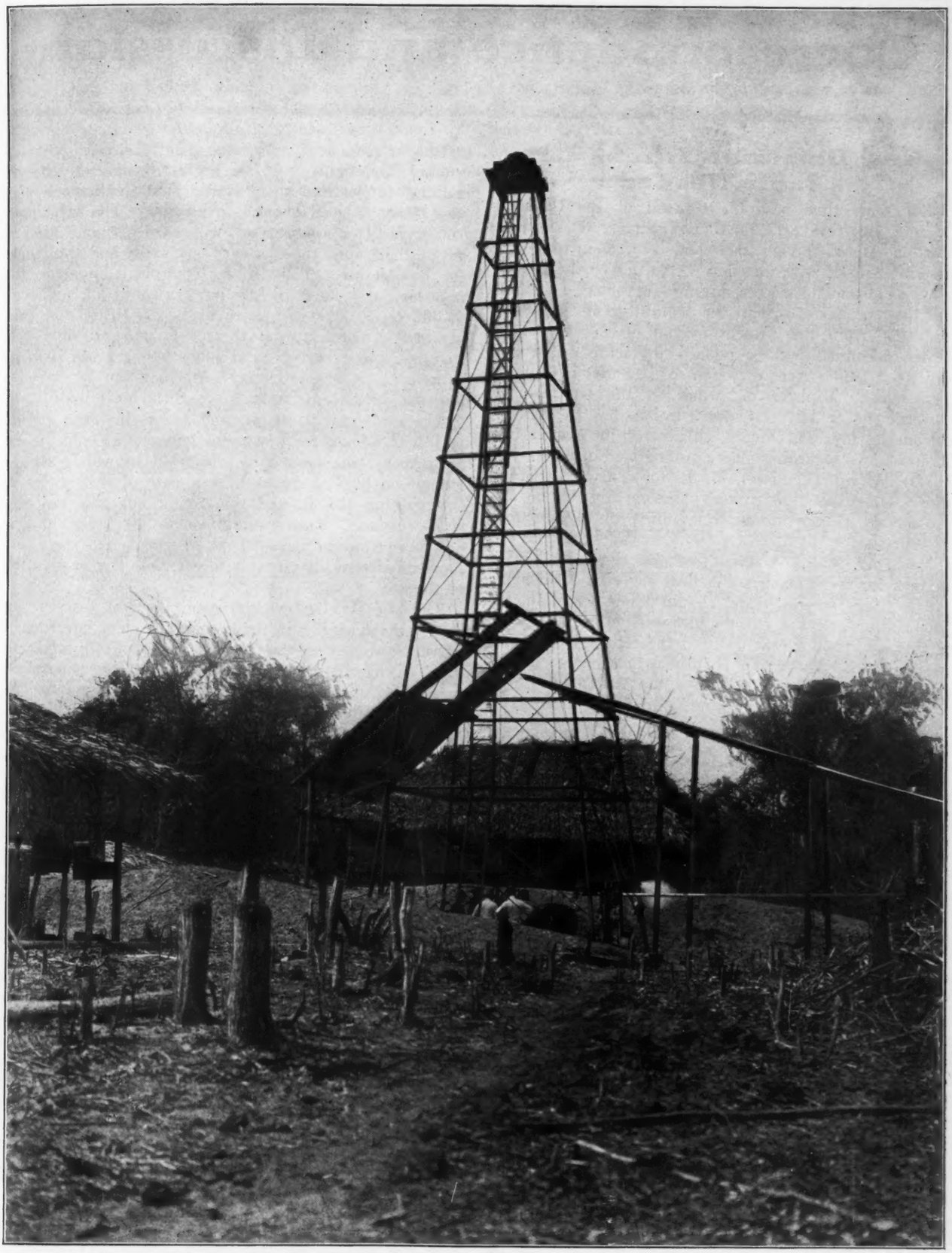
CHINESE OPERATING A LEYNER DRILL SHARPENER AT TUL MI CHANG MINE, CHOSEN



MONUMENT AT COLOMA, CALIF., TO JAS. W. MARSHALL, WHO DISCOVERED GOLD IN CALIFORNIA ON JAN. 12, 1848



SOUTH FORK OF THE AMERICAN RIVER AT COLOMA, CALIF. THE TWO WHITE BOULDERS AT THE WATER'S EDGE ARE AT THE SPOT WHERE MARSHALL DISCOVERED GOLD



A CALYX CORE DRILL ON EXPLORATION WORK IN BRAZIL, SOUTH AMERICA

This work is prospecting for coal in the state of Maranhoa, where considerable mining work is being done at present

Correspondence and Discussion

New Dominion Mining Law Badly Needed

For some time past the Council of the Canadian Mining Institute (H. Mortimer-Lamb, secretary, Ritz-Carlton Hotel, Rooms 911 and 912, Montreal) has associated itself with an endeavor to induce the government at Ottawa to place a mining law for the Dominion on the statutes, so that the condition of instability resulting from the present system of regulations by Order-in-Council will be replaced by more stable conditions. Under the direction of the Hon. William Templeman, Minister of Mines in the late Laurier Government, a bill was drafted, but has never been introduced into Parliament, chiefly for the reason that its provisions regarding placer mining were not approved by Dr. Alfred Thompson, M. P. for Yukon Territory, who claims that the present Mining Act is entirely satisfactory to the mining community of the territory he represents.

Now, one would imagine that the chief director of surveys for the Yukon, a practical surveyor resident in the territory several years, should know something of this matter and the effect and results of the working of this law, from a practical, not theoretical, standpoint. And he does. The writer is intimately acquainted with the late chief director of surveys for Yukon Territory.

In a letter to the *Mining Journal,* dated Jan. 16, 1915, the writer said:

> **F. H. Kitto, director of surveys in Yukon Territory, summarized, at Ottawa, the objectionable features of these placer-mining-claim regulations and offered suggestions for correcting their many incongruities, and it is to be hoped the department, under whose jurisdiction these surveys are made, will act on them. The unsatisfactory conditions under which the miners labor, the endless confusion and litigation and the utter inability of the surveyor to work intelligently, all call for a drastic change.**

This phase of the subject has been dealt with in the recent article in the *Engineering and Mining Journal,* entitled "Remedies for Incongruities in the Yukon Placer-Mining Regulations," and it is possible that at least some of these suggestions may be embodied in the forthcoming bill. One of the best discussions on these incongruities is embodied in a paper read before the Association of Dominion Land Surveyors, by Mr. Kitto, at Ottawa in February, 1915, which I trust the Council of the Canadian Mining Institute will read carefully, for it contains the views of a practical surveyor and mining man who has no political interests to conserve. But there is another objectionable feature in the present Yukon Mining Act: The prospector of dredging ground in the Yukon is handicapped by the regulations which require the payment of $100 per mile of river bed 60 days after application is made or, rather, filed. He is allowed to acquire 10 mi., but has to pay $1,000 down, $10 per mile each subsequent year of the existence of his leasehold, and within three years of the issuance of his lease is required to place on the property a dredge approved by the Minister of the Interior.

One or more seasons will be required to prospect his ground thoroughly. If he begins prospecting before making application, he is at the mercy of anyone who may deem it good enough to acquire. The stipulated "60 days after application" will hardly enable him to get on the ground the necessary machinery and appliances for prospecting. The drilling equipment to make the necessary tests will cost a large amount of money—$3,000 to $5,000—laid down at White Horse and take at least a month to get there. It will probably cost as much more in time and money to get the drilling equipment on the property. All that can be done in the "60 days" is to make a superficial examination.

The minimum width allowed for a dredging stream is 150 ft. Should a prospector have a leasehold 10 mi. long, measuring from 200 to 300 ft. in width, such a stream ought to have at least a pair of drill holes at intervals of 500 ft. and this would not give too conclusive a test. This would involve 100 weeks, and as a favorable season means about 22 weeks, it is clear that it would involve five seasons to complete the prospecting of the area.

The late Mr. Ogilvy, who spent the best years of his life in the Klondike in the capacity of chief government surveyor, suggested this: That the applicant after 60 days be required to pay down 10% of the purchase money and to begin, as soon as practicable, comprehensive prospecting operation or work, not limiting the time to any specified number of days, for what would be possible in one place would be absolutely impossible in another.

The territorial mining engineer or some other competent authority should be able to decide easily what was and what was not possible in each individual case. Then as soon as a sufficient portion of the leasehold was prospected and results warranted it, the installation of a dredge should be required within a reasonable time. Should all the ground not prove profitable, the privilege of abandoning the unprofitable portion should be permitted and the balance of the prospecting fee on this portion of the property should be refunded.

A dredging leasehold 10 mi. in length, having an average width of 300 ft., contains 363 acres; the recording fee for the first year is $1,000 and is $100 for each subsequent year. The representation work on a dredging lease, as the law stands at present, is—exclusive of prospecting which is absolutely necessary—for the first three years $75,000 to $100,000, which is equivalent to the cost of a dredge; this, before a wheel is turned, may be several times that amount. This would be at the least estimate $30,000 a year for the first three years, or nearly $250 per acre.

The dredger is required to do certain work each year, and if he fails, he is liable to lose all. This decision is in the hands of the Minister of the Interior at Ottawa, and it may be assumed that this gentleman will never impose any unreasonable or unnecessary hardship—provided political exigencies do not interfere.

There is, however, no positive assurance that the Minister may not exercise the right of cancellation permitted by the regulations, and this thought naturally engenders doubt in the mind of the investor.

The future of dredging is the future of a large area in the Canadian Yukon, which is too poor or too difficult for the miner of small means to operate by sluicing. It is not therefore unreasonable to ask consideration of the restrictions placed on the dredger. He must have more assurance against loss and more freedom of action. He cannot assign his leasehold without the consent of the Minister of Ottawa. J. A. MACDONALD.

P. O. Box 83, Ottawa, Ont., Canada, May 13, 1916.

[Doctor Thompson was not the only one who opposed the new Mining Act as drafted. Many of its provisions were objected to by Mr. McConnell, the present director of the Geological Survey of Canada, Mr. McEvoy, and many others with experience in western Canada. Doctor Thompson's objection was backed up by the very reasonable statement that the Act would be thoroughly unpopular throughout the whole Yukon Territory. Mr. Macdonald leaves it to be inferred that the mining laws of Yukon Territory are regulated by Order-in-Council, while, as a matter of fact, placer mining in the Yukon has for many years been governed by a definite Act of Parliament, though quartz mining is still governed by Order-in-Council.

Laws must be efficiently administered if they are going to be of any service. J. H. Curle saw the conditions clearly when he visited the country, and the following statement by him well fits the case:

> The handling of the mining industry—the backbone of the country—has been weak and inefficient. There are, firstly, far too many officials, and from the gold commissioner downward, nearly all are ignorant of mining matters. The local mining laws are weak; the miners are for ever quarreling over boundaries and water rights, and the only remedy appears to be a lawsuit, or series of suits, in the local courts. The gold commissioner, his assistants and the claim inspectors seem to have no power, or to be afraid to use it. Their only remedy is, "Oh, take it into court." Dawson, as a consequence, reeks with lawyers and litigation. A couple of Australian mining wardens of the old school, who would ride up the creeks themselves, interrogate the parties to a dispute, and settle the matter on the spot, sticking the boundary and water-right pegs into the ground themselves and warning the men to touch these at their peril, would do more good than the dozens of officials there now and would soon empty the courts of litigants.

He might have added that most of the officials were thoroughly venal and the people had no confidence in them. We have not read Mr. Kitto's paper, but should be inclined to give much more weight to the opinion of a mining engineer or mine operator than to that of a government surveyor.

The dredging regulations, as quoted by Mr. Macdonald, appear to be correct. A man could not expect to get a mile of river bottom for much less than $100, and $10 a year rental is purely a nominal sum. These conditions are very much easier than they were in the early days of the Klondike, and if a man seriously considers acquiring dredging ground, it would be difficult to think of any place where he could get it cheaper. One valid but humorous criticism that was made on the mining laws years ago is recalled, which might still apply, namely: The Government should give a man a good piece of ground for his money, and if the ground first given was found not to be good, it should take it back and give him a piece that was good.

Mr. Macdonald has made one good point, in that a man should not forfeit his ground for temporary failure to satisfy the Minister of the Interior that he was doing a certain amount of work, for the Minister is advised by his clerks in the country and these can generally be bought or influenced one way or the other. As to the consent of the Minister to a transfer, this is a formal matter and has never been denied to people of any financial strength whatever.—Editor.]

Can You Beat It?

The London Arizona Consolidated Copper Co. shipped 500 tons of copper ore during the month of March. This ore is extracted from tunnels and cuts and placed in piles. These piles, when large enough, are shoveled into boxes, which are carried on burros a distance of from one to three miles and emptied upon a platform. The ore is then shoveled into wagons and hauled to the railroad, where it is shoveled upon a makeshift platform. Then it is shoveled into a car and shipped.

The railroads will neither put in shipping facilities nor permit others to do so. The ore is mined from a stratum on the face of a cañon about two miles long, running east and west. Two miles south of this other work is going on; two miles west, ore is being extracted.

All the work is in charge of one man, who is also the superintendent, physician, foreman, shiftboss, cashier, surveyor, buyer, storekeeper, roadboss, stableman and horseshoer. He does his own housework, cooks his food and pays for it from his own cash. He said a so-called big corporation made a contract a year ago to open the ground, but so far nothing has been done and the bondholders don't want such a corporation on the property. He said, moreover, if the would-be capitalists will keep away he will show up such a quantity of ore that some sensible man will gladly erect a smeltery on the ground. Can you beat it? L. LYNDON.

Winkelman, Ariz., Apr. 3, 1916.

Mexican Complexities

The article in the *Journal* of May 27 on "Mexican Complexities" is so true that I want to add my confirmation of it. Formerly, whenever one got away from the border or from the railways, the people were easy to get along with. I have been alone for months, working 50 to 100 of them in the interior, and had no trouble. I have put in 30,000 mi. in the saddle in Mexico and always was made welcome at the house of the poorest peon or at the richest hacienda. Several times the only bed has been given up to me. I have known them to sell their last *decalitro* of corn to travelers—strangers—when they themselves would have to go miles to buy more. Mexico used to be all right. There is no telling when it will be so again. G. L. SHELDON.

Ely, Nev., May 31, 1916.

Contraband

I am sending a sample[1] of a mineral locally known as "stolenite." Specimens of this kind are found at Atolia, Calif. I am reliably informed that the mineral is used there as (il)legal tender at poker tables.

Los Angeles, Calif., Mar. 31, 1916. SUBCRIBER.

[1]The sample received was a rich specimen of scheelite.

The Cruise of the "Cyprus"

D. C. Jackling is the owner of the steam yacht "Cyprus," which word is the origin of our word "copper." The home station of the yacht is San Francisco, whence Mr. Jackling goes in her on his inspection trips to Alaska. About three months ago he, with a party of friends—including Charles Hayden, K. R. Babbitt and Mr. and Mrs. Sherwood Aldrich—steamed south in her to visit mines on the West Coast of South America. On June 1 they arrived in New York. The rest of the story is as told picturesquely in the *Globe*:

Harbor men were thrilled to-day by the picturesque sight of a large yacht as she steamed into the East River at 18 knots on her way to an anchorage off the New York Yacht Club at Twenty-third St. Above her long, graceful lines black smoke was rolling back from her two rakish funnels, on her forward deck two brass guns to ward off possible pirates gleamed in the sunlight, and her sheer prow laying back the white foam on either side, bore in gilt letters the name "Cyprus."

On the bridge, in an immaculate yachting suit and watching the harbor panorama unroll before him, stood the owner, D. C. Jackling, a copper and gold mining man of San Francisco, who, accompanied by his wife and 12 guests, was finishing an 83-day cruise from the Golden Gate, some 17,300 miles.

On coming ashore he said that the "Cyprus" had touched at many ports of South America, and that for 51 of the 83 days the engines had turned over continuously.

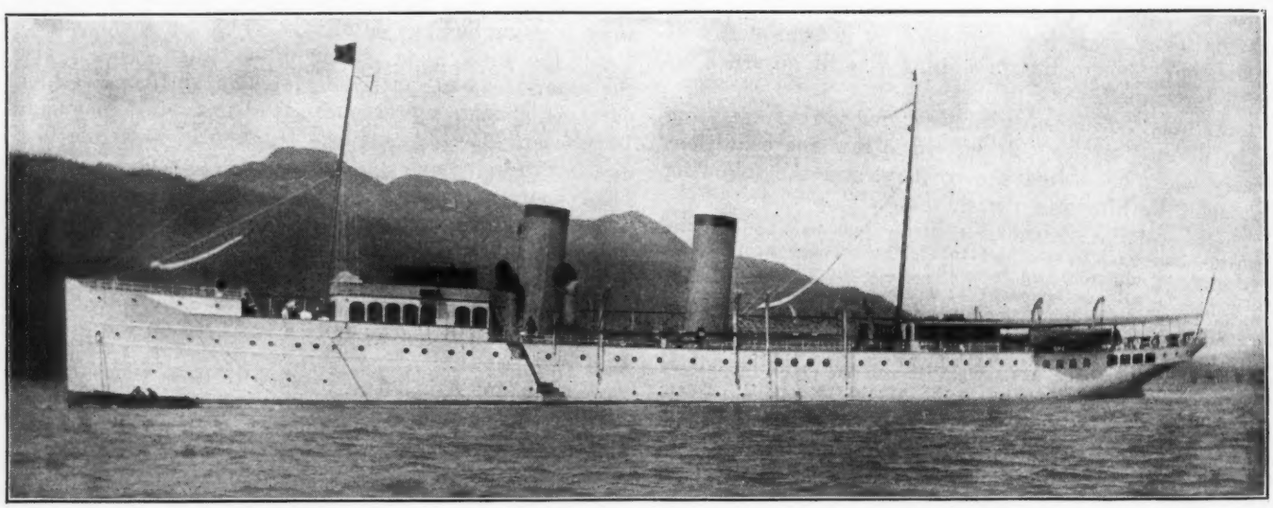
"Our party left the yacht at Valparaiso, and journeyed by rail to Buenos Aires, where she picked us up again," said Mr. Jackling (the yacht had come around Cape Horn in the meanwhile). "Later we touched at Kingston, Santiago and Havana, and from the Cuban capital we have made New York in just three days."

It is worthy of note that the liners usually take at least four days from Havana to New York.

"Yes," Mr. Jackling went on, "in the 17,300 mi. we have maintained a speed of 13½ knots for the whole time."

The "Cyprus" was built several years ago at Seattle, after designs by Cox & Stevens, of New York, is well over 300 ft. long, and displaces 2,500 tons. She carries a crew of 50 and has 15 cabins capable of accommodating 30 guests. She has every appointment known to the modern yacht and a few not to be found elsewhere, among them a complete motion-picture theater and a golf course.

After her owner, who is attending to some business at his New York office, 25 Broad St., has made an overland trip to San Francisco and back, the "Cyprus" probably will carry another party on a cruise in eastern waters.



THE OCEAN-GOING STEAM YACHT "CYPRUS," OWNED BY D. C. JACKLING

New Strike at Goldstone, Calif.

By Leroy A. Palmer*

A new strike of rich gold ore has been made a few miles from Barstow, Calif., which is attracting a great deal of attention locally and causing a growing interest in outside circles.

The strike is in what has been named the Goldstone Mining District, near the southwest corner of T 14 N, R 1 W, San Bernardino meridian and about 33 mi. slightly east of north of Barstow, the nearest post office. It is reached by motor in about two hours over good roads with only one stretch of bad grade. The elevation is about 3,500 ft. The location is at the edge of the Mohave Desert where the foothills of the Granite Mountains rise by moderate slopes to a slight elevation above the surrounding country.

The first location in the district was made by G. L. Drumm and W. M. Clancey, who discovered and located the Big Drumm claim Mar. 17, 1910. After doing assessment work on this property for three years, they sold it to a Boston company, which sunk a vertical shaft to a depth of approximately 75 ft.

While this was being done, about the middle of February, 1916, the two Redfield brothers, who were working for the Big Drumm and doing some prospecting on the side, were going over some ground—to the northwest of the Big Drumm claims—which had been located in 1910 by Charles McElroy and allowed to lapse. While sitting on a ledge to rest, one of them casually knocked off a piece with his pick and discovered that it was liberally

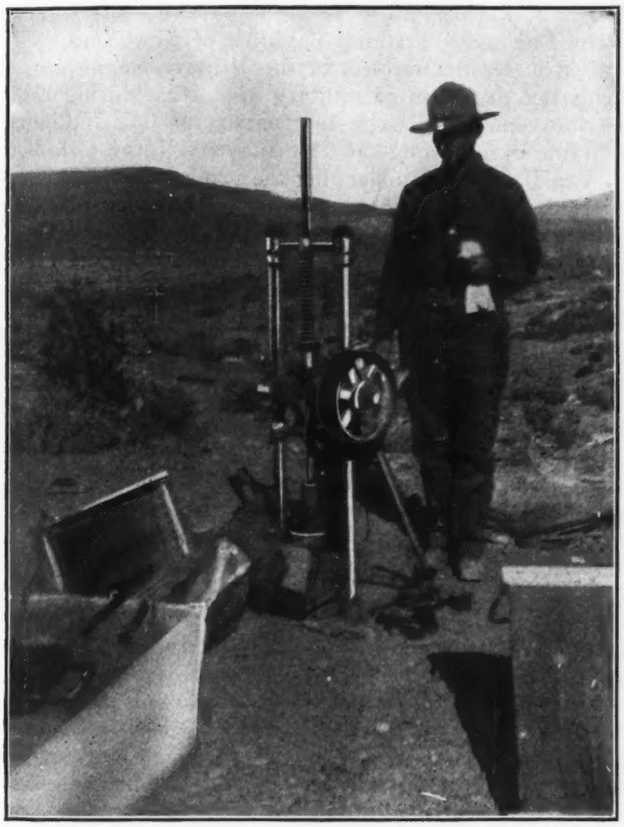
*Mining engineer, 512 Custom House, San Francisco, Calif.

sprinkled with free gold. They immediately located three claims, which they sold shortly after to the Boston company for $15,000, and the Goldstone Mining Co. was organized to work the group. On further inspection of this property, the old McElroy location monument was found, a closer examination of which showed it to be composed of quartz fairly glistening with free gold.

Following their sale of the Goldstone group, the Redfields made further locations to the northwest and exhibited rich specimens therefrom. These discoveries started a local stampede, and within a few days the district was located for a length of seven miles and a width of one mile.

Quartz Fissure Veins

As far as observations go at present, the structure of the district is a syncline with its axis striking about N 35° W. The present activity is in a series of easterly dipping



ONE-STAMP MILL AT GOLDSTONE

strata underlaid to the west by a quartzite which appears to be identical with a quartzite appearing at some distance to the east also. Overlying this quartzite is a gray lime, distinctly stratified and interbedded with shale. The contacts between the lime and the shale appear very distinct, and they doubtless belong to the same series, while the quartzite is distinct and earlier.

The strike of the bedding planes is approximately N 35° W, with easterly dip very steep, frequently vertical or nearly so. These sediments are older than certain lake beds found to the south and known to be Tertiary, but further than that they are pre-Tertiary nothing definite can be said at present.

Traversing these sediments on a strike of N 10° W is a system of parallel dikes of which at least four outcrop prominently. These dikes are of a light greenish-gray rock, fine-grained and tentatively called andesite. The veins are found with westerly dip on or near the contacts of the dikes with the country rock. The Goldstone vein is in a limestone hanging and a shale foot wall but within a few feet of one of the most prominent of the dikes. Whether the dikes cut the Tertiary lake beds has not yet been ascertained, so that their age is not known. It is not supposed that they do, which of course places them in the pre-Tertiary also.

The average width of the veins is approximately 4 ft. The Goldstone vein seemed to have this width, but at first what appeared to be the shale foot wall turned out to be a horse, and the true width had not been determined at the time of writing.

The veins appear to have been formed by upward circulation in true fissures. They are well-defined with a zone of slight brecciation of the walls, which is mineralized by stringers from the main veins. The Goldstone vein can be traced readily for several thousand feet. The pay shoot is a heavily oxidized quartz found on the hanging wall. Southerly from the main group of claims is a series of veins, less prominent, with a strike almost due east and west.

Little Development Done Thus Far

At the time of writing (six weeks after the first strike), little development had been done. The Goldstone has an opencut on the vein and is sacking ore that the engineer states ran, on grab samples, over $200 per ton. The Big Drumm brought in the small one-stamp mill shown in the accompanying illustration before it sold out to the Boston company. This is the only mill the district has ever had. After hauling water from Indian Springs, 9 mi. distant, the mill was set to work and laboriously pounded up three tons of rock which plated $196 and left $20 in the tailings. A ledge on the Belmont, south of the Big Drumm, has been followed 80 ft. in a shaft with widths of from 2 to 4 ft. and assays of from $2 to $12. Northwest of the Goldstone is the Redfield group. This shows a few shallow cuts, and samples taken almost anywhere in the vicinity of the veins will pan on crushing, but the owners were reticent about giving out definite information or allowing sampling, so not much can be said about it.

So far there has been so little development work in the district, and none of it systematic, that no one can form a conclusion concerning it. There are certainly some enticing surface showings. From the stringer on the Big Drumm a small tobacco-can full of dirt yielded $11 and the vein assayed $150 to the ton for a width of 2 ft.

The Goldstone vein, particularly, is well-defined and can be traced across country for a considerable distance. It is undoubtedly a true fissue which can be expected to go to depth. Whether the values will persist is another matter, which can only be proved by further development.

Report of the Territorial Mine Inspector of Alaska to the Governor for the year 1915 has been made, and covers in an interesting way the mining operations of all kinds in the Territory during that period. Not the least interesting part of the report is a complete list of all the dredging companies, quartz mines, and placer mines in the Territory, with their addreses and in each case the name of the manager or operator. During the year 168 placers, 31 quartz mines, and 30 dredges were inspected. Out of a total number of 5,000 men employed in and around the mines in the Territory, there were 23 fatal accidents during the year, being a ratio of 4.6 per 1,000 men employed.

Granby-American Zinc

On June 5 the American Zinc, Lead and Smelting Co. exercised its option to acquire the entire capital stock of the Granby Mining and Smelting Co.—200,000 shares at $400 per share, total $8,000,000. Payment is to be made in the form of cash $6,000,000 and $2,000,000 in bonds to be issued against the Granby properties. The American Zinc, Lead and Smelting Co. will pay $4,000,000 cash out of its surplus and will obtain the remainder by selling 40,000 shares of new common stock to its shareholders at $50 per share.

The Granby company owns zinc and lead mines in southwest Missouri, a lead smeltery at Granby, and zinc smelteries at Neodesha, Kan., and East St. Louis, Ill. The latter—the Rose Lake plant—comprises a sulphuric-acid factory. The following statement is made by one of the officials of the American Zinc, Lead and Smelting Co:

In behalf of the Granby company, a Maine corporation, which he has organized for the purpose, H. S. Kimball, president of the American Zinc, Lead and Smelting Co., has purchased the Granby Mining and Smelting Co., a Missouri corporation.

The Granby Mining and Smelting Co. of Missouri was organized in 1864. It owns in fee approximately 30,000 acres in the zinc district of southwestern Missouri. For about 50 years, and until quite recently, its revenues have come from royalties paid by lessees operating on these zinc lands. Within the last two or three years it has itself developed deep ore at Granby, Mo., and it is now operating from this deep ground a mine with a large known tonnage of exceptional richness, and has started other similar developments in the same field.

The Missouri company has been a dividend payer practically since its inception, and it has, out of earnings, acquired 10,000 acres of coal land in Illinois; has built a new coal-zinc smeltery and sulphuric-acid plant in East St. Louis similar in character and capacity to the Hillsboro smeltery of the American Zinc, Lead and Smelting Co.; has bought and improved a gas-zinc smeltery at Neodesha, Kan., similar in character and capacity to the American Zinc, Lead and Smelting Co.'s Dearing plant, and has acquired a small lead smeltery at Granby, Mo.

The spelter produced from these properties is known as prime western and brass special, these brands being different from the high-grade Mascot and intermediate brands which constitute the major portion of the American Zinc, Lead and Smelting Co.'s spelter.

Approximately 75% of the Granby spelter to be produced during the balance of the year 1916 has already been sold on firm contracts, together with a considerable tonnage through 1917, and all of its sulphuric acid has been sold up to and through 1920, all of these sales and contracts being at very satisfactory prices.

The net quick assets of the Granby company of Missouri exceed $2,750,000, of which nearly $1,000,000 is in cash. Its current liabilities are less than $300,000. From sales already made, the net quick assets of the Missouri company should be increased to above $4,000,000 by Jan. 1 next.

The Granby company of Missouri has just declared a dividend of $2,000,000, in the form of 10-year 5% bonds, secured by mortgage of its real estate, and the company, subject to this mortgage, has been taken over by Mr. Kimball in behalf of the Granby company of Maine for $6,000,000. It is proposed that the American Zinc company shall acquire the property, together with all the quick assets, at the exact price paid by Mr. Kimball.

By the purchase of this large acreage, much of which is known to contain extensive zinc-ore deposits, the American Zinc company wil obtain an assured supply of high-grade zinc concentrates, enabling it to produce, at a low cost per pound, spelter of a character different from and supplementary to the brands it is now producing. By pursuing the same policy of development in this new field it has pursued in regard to its Mascot properties in Tennessee, its earning capacity will be greatly increased and assured for a very long period of time.

The net quick assets of the American Zinc, Lead and Smelting Co. as of June 1 were approximately $7,000,000, and of the Granby (Missouri) company approximately $2,750,000, a total of nearly $10,000,000, so that it would be feasible to finance this purchase entirely out of earnings; nevertheless, after consideration, the directors of the American Zinc company believe that a portion of the purchase money should be provided by an issuance of common capital stock.

A meeting of the stockholders of the American Zinc company will therefore probably be called in the near future to authorize the issuance of additional common shares, and if the authority is voted, the directors will issue approximately 40,000 new common shares, to be offered to stockholders at $50 a share, thus providing approximately $2,000,000, the balance of the purchase price to be paid out of earnings.

St. Louis banking interests representing in part a portion of the Missouri company's stockholders and certain large stockholders of the American Zinc company stand ready to take, at $50 per share, without commission any stock not subscribed for.

The properties of the Missouri company have been carefully examined and accounts have been carefully audited, not only by its own engineering and operating forces, but by well-known outside engineers as well, and their reports, and the purchase of the properties by Mr. Kimball, have been predicated entirely upon the value of the properties and their earning capacity on a 5-cent. spelter market.

New York Engineers Training Battalion

The Engineers' Training Battalion of New York, organized under the auspices of the Military Engineering Committee, has received military instruction during the last three months through the courtesy of Col. William G. Bates, commanding the 71st Infantry, Lieut.-Col. E. W. Van C. Lucas, commanding the 22nd Corps of Engineers, and officers of their commands. A review of this battalion by Major General Wood and the Military Engineering Committee was held at the armory of the 71st Infantry, June 1.

Although the battalion has been drilling but twice a week for three months, the showing made was most creditable and was favorably commented on by many army officers who witnessed the review unofficially. Omitting the usual platitudes regarding changes and benefits therefrom, one change is significant and worthy of comment. This short service has sufficed to implant in the mind of almost every one of these engineers the desirability and advisability of universal compulsory military training in this country.

The same evening, at a dinner given to Col. Charles H. Sherrill, the grand marshal of the preparedness parade held May 13, the official figures of the parade were given for the first time. The number that paraded was 140,139. Col. Sherrill said, "It is well to remember that it took six weeks of hard work by hundreds of men to put this parade on the street, and yet we did not equip, or feed or transport them. This proves that talk of raising an army of a million armed citizenry overnight is only political bosh."

Rights Under Lode Locations

A mining company's acquisition of mill sites under locations made by others did not constitute any waiver of the company's independent rights under mining-lode locations, according to a decision of the United States Circuit Court of Appeals, Ninth Circuit, in the case of Alaska Juneau Gold Mining Co. vs. Worthen Lumber Mills, 229 Federal Reporter, 966, affirming a decree of the United States District Court for the District of Alaska. It is further decided in the same case that any representations made by the mill-site locators that it was nonmineral in character could not be imputed to the mining company, unless it procured the locations to be made.

Editorials

The Reasons for the Recent Freight Embargoes

The New Haven railroad has explained the reasons for the recent embargoes on freight, which were so vexatious to all shippers, including the shippers of copper, spelter and lead, that are consigned so largely to points in Connecticut. In general the trouble originated from the unnecessary concentration of shipments, especially coal, within certain periods and the chronic delay in unloading freight of all kinds. As remedies the railway officials have recommended the following to shippers:

Ship at an average rate, only as rapidly as unloading is assured.

Help to avoid accumulations in the freighthouses.

Load and unload every car promptly—the day it is placed, if possible.

Endeavor to get all cars on any certain track loaded or unloaded each day, so that the track may be cleared and respotted as a whole. This is of great importance where tracks are used for other switching movements and main tracks required for important and fast trains.

Get in your supply of coal for next winter during the season of favorable weather, commencing immediately, ordering shipments forward moderately and at a regular rate. It was the overbuying of coal in large quantities last fall that started the serious congestion during the past winter.

Improve your existing facilities, where possible, for unloading, handling and storing freight, requesting the coöperation of the operating, transportation and engineering officers of the company, who will do all they can to help you work out and make effective any such improvements.

Use your influence with all other shippers and consignees in your neighborhood in order that the delinquency of one may not penalize the many.

If shipments are not received when expected, do not order in excess of immediate requirements, and thereby commence the creation of a situation that cannot be handled, but take the matter up with the representatives of the company, and attention will be given by the transportation department. The transportation department will be able to help if freight is promptly taken away at destination, but an undue accumulation increases the difficulties and causes delay in getting the records necessary to trace your shipments and then giving you the assistance required.

This statement is important in that it clears away the suspicion that the railway-carrying capacity of the eastern part of the country had become insufficient and that large sums of new capital would be needed to increase it. The New Haven road serves the most congested territory, and its experience may fairly be taken as an index of that of other Eastern roads. Manifestly the prime remedy is simply better organization—more brains. E. E. Clark, interstate commerce commissioner, recently said that the capacity of the New Haven road was decreased 50% by slow unloading. Anybody who travels among the freightyards, factories and coal depots of New England—and elsewhere for that matter—cannot fail to be impressed by the clumsiness and costliness of handling freight after the cars have arrived at their destinations. If material were handled in such ways in mines and smelteries, there are many good dividend-payers that would not pay anything. Without any doubt a good deal of capital ought to be laid out in improving facilities, but the first thing to be done is to inject some high grade of gray matter into the problem and devise a better organization.

The Handwriting on the Wall

During the last year we have witnessed extraordinary rises in many of the metals—figures having been attained that five years ago would have been characterized as preposterous if anybody had talked about them. Among the major metals zinc has been the most spectacular; among the minor metals aluminum, antimony and tungsten have been the star performers. Of late there has been a sharply declining tendency in the markets for zinc, antimony and tungsten that probably foreshadows the return of those metals to normal levels. There is nothing mysterious or malevolent in the recent behavior of these markets. On the contrary their action is precisely what ought to be and what has been expected all along.

The cycle is obvious. Extraordinary and insistent demand elevates price. High price stimulates new production. Sooner or later the time comes when the supply outstrips the demand, whereupon the price declines, eventually reaching the normal level at which the business may be conducted with the ordinary percentage of profit. The time of such a cycle is determined primarily by the facility with which new production may be organized.

In spelter the deficiency was never of ore supply, but rather of smelting capacity. During the last year new smelting capacity has been provided in a rapid and even romantic manner. Since the first of 1916 the reports of the organization of new smelting companies have been so frequent that it became a good deal of a job to keep track of them. Similarly has the production of antimony ore and tungsten ore been stimulated in all parts of the world, but especially in the United States. Let anybody run over the weekly record of mining news in the *Journal* and note the number of new antimony and tungsten mines being worked in all quarters. Even the old antimony mines of Arkansas and the old tungsten mine of Connecticut have been reopened. Declines in prices were inevitable.

The same things will eventually happen in the cases of copper, lead and aluminum. That it has not already happened with those metals is due to the facts that the production of them could not be increased so quickly and moreover, the business in those metals is more concentrated and better organized than in other cases, and for that reason, partly, the advances in them were not so extravagant.

The alarming thing about the return to normal conditions is that so many people have forgotten what normal conditions are. Tungsten miners are grieving about the depression in their industry arising from a decline of the price for ore to $50 per unit! Previous to the war tungsten ore was worth about $6@7 per unit. In the Joplin district there is resentment respecting the fall in the price of zinc ore to $85 per ton! Previous to the war it was worth about $40@45. Both in the tungsten and zinc districts mass meetings are being held to consider what steps should be taken to relieve the suf-

fering miners, threats are being made to the effect that ore will be held back until smelters pay what it is worth, that mines will be closed down if necessary, that the wages for labor will be reduced, that there will be steps to secure a tariff that will keep ore prices up to what they ought to be, namely, the maximum attained during the war period.

This exhibition of greed is human, but nevertheless is mortifying by reason of its childishness. However, there is no doubt that many people are going to lose money in the further decline of prices for ores and metals from levels that even now are extravagantly high. High prices had the natural effect of bringing into production mines and works that normally could not pay. Mines were equipped and new works were built. The phenomenal profits that were expected were sadly eaten into by the insatiable demands of labor and the increasing inefficiency of labor. When some people talk about being unable to produce zinc ore for less than $75 or $80 per ton they are probably telling the truth. Deposits yielding only 1 to 1½% zinc have been opened in the Joplin district.

Those miners and smelters who started early and have recouped themselves will prepare to go out of business when the bell rings. This will relieve the labor situation and will pave the way for the reduction in wages and weeding out of the inefficient that is inevitable. It is to be hoped that this will come about with no great disturbance, but it will not come about until there is a surplus of men and the good ones are anxious to keep their jobs. There will be, of course, a good many miners and smelters who started late and will never recoup their investments. This will happen to many who bought properties at high prices from the far-seeing who cashed in early. They will have to console themselves with the unsatisfactory thought that they took a chance and lost.

The recession in the metals does not indicate slackening in business so much as it does increased production stimulated by the high prices. Nobody is responsible but the producers themselves. They could not eat their cake and have it too. Eventually the same thing will happen in copper, but that is probably still rather far ahead. The production of copper is not something that may be instituted quickly. The creation of a new producer takes millions of money and years of time. This is why copper is the strongest of the metals. There have been no new producers of great consequence since the outbreak of the war except Inspiration and Chuquicamata, which fortunately were just coming in at that time.

Increase in Our Foreign Trade

The enormous increase in our foreign trade is generally supposed to be largely due to the exportation of munitions of war. According to figures compiled by Dr. Edward Ewing Pratt, chief of the Bureau of Foreign and Domestic Commerce, Department of Commerce, at Washington, this is not so. Our foreign trade in 1915 amounted to $5,333,000,000, as compared with a total in 1913 of $4,277,000,000. At the present rate our foreign trade for the fiscal year ending July 1, 1916, will amount to $6,300,000,000. Of these rather incomprehensible figures, the increase in the exports of munitions has actually been less than the increase in the amount of secondary war supplies exported or the items that have no direct relation whatever to the war. The largest increase in exports has occurred in the groups which might be called "secondary war supplies" and those articles which have no direct connection with the war. The smallest increase in actual amount has taken place in the direct munitions of war.

The increase in exportations of munitions of war to the belligerent countries for six months ended Dec. 31, 1915, was approximately $153,000,000; the increase in exports of secondary war supplies to belligerent countries for the same period was approximately $195,000,000; while the increase of exportations which have no direct relation to the activities of belligerent nations and of all other products to belligerent and neutral nations amounted to approximately $188,000,000.

However, since the British quartermaster list is said to contain 50,000 different items it is more than probable that most if not all of the products listed as having no direct relation to war do have such relation. The viewpoints of a British quartermaster and a United States bureau official are quite different.

British Shipping in 1915

Statistical tables for 1915 have just been issued by "Lloyd's Register of Shipping," which show some interesting figures concerning the shipbuilding industry of England during the last year and throw some interesting sidelights on the direct effects of Germany's submarines.

The total addition of steam tonnage during the year was 1,461,816 tons gross and of sailing tonnage 61,934 tons gross, or in all, 1,523,750 tons gross. Of the tonnage added about 51% consisted of new vessels, practically all built in the United Kingdom.

The gross reduction of steam tonnage amounted to 1,452,679 tons and of sailing tonnage to 82,222 tons, or in all to 1,534,901 tons. Of this decrease 232,949 tons was sold to foreign owners during the year.

During 1915 the number of steamers on the official Register of the United Kingdom decreased by 86, but the tonnage increased by 9,137 tons, while the number of sailing vessels decreased by 182 and the tonnage by 20,288 tons. The total number of vessels on the "Register" therefore decreased by 268 and the total tonnage by 11,251 tons during the year.

Despite the fact that it takes many months to build a ship and only a few minutes to sink one, these figures show that the English have been building ships faster than the submarines have been sinking them.

London Metal Exchange

With May 31 speculation on the London Metal Exchange ceased by order of the British government. Thereafter trading was permissible only with purchasers who intended consuming the metal. On the other hand, the seller must have the metal. There is to be no more short-selling.

The London Metal Exchange will thus become even more of a shadow of itself than ever. For a long time nobody in the wholesale metal business of the United States has paid any attention to the quotations cabled from London. The absolute absence of meaning in them may now be emphasized more than ever.

BY THE WAY

According to dispatches from Chihuahua City, Mexico, Pablo Lopez, leader of the Villa band that murdered 17 American mining men at Santa Ysabel, Chihuahua, and supposed leader of the Columbus N. M., raid, was shot by a firing squad of Constitutionalist soldiers on June 5 at Santa Rosa, Chihuahua's place of execution.

⁂

John Papassimakes made a big gold strike up in Ontario a short time ago, and after him the new mining territory at Boston Creek was denominated "The Greek Strike." The story of Mr. Papassimakes, as it has come from the Canadian gold fields, is one of romance. Report credits him with being a member of a noble Greek family. Anyhow, he was a painter of pictures when he went up into the wilds of Ontario, looking for scenery to paint. The discovery of the yellow metal was purely an accident, and now Mr. Papassimakes does not have to make pictures except for pastime, and is rated among the gold millionaires. "Some men are born great, some achieve, etc."

⁂

"Sleeping sickness" following the bite of a tsetse fly in West Africa five years ago, is reported to have caused the death of Dr. Albert Curtis Perveil, of 14 Hancock St., Brooklyn. Dr. Perveil, who was a graduate of the medical college of New York University, went to Africa in 1910 as physician for the Offin River Gold Estates, Ltd., in Nigeria. While canoeing along the Congo (?) River with a band of prospectors, he was bitten by a tsetse fly and, according to the *Times*, went to Paris for treatment at the Pasteur Institute. He apparently recovered from the effects of the poison injected by the fly. While in Belgium at the outbreak of the European War he was again taken ill and returned to his mother's home. He was attended by several physicians, but gradually grew worse. After several months' treatment he recovered sufficiently from his lethargy to walk about his room. Several weeks ago he was removed to Roosevelt Hospital for an operation on his spine. The hospital authorities would not say whether or not the proposed operation had been performed. They simply announced that he died at noon on May 30.

⁂

The scarcity of ocean tonnage has some far-reaching effects. Thus a report from U. S. Commercial Attache P. B. Kennedy, at Melbourne, Australia, says: "The embargo on the export of coal from Australia, established some time ago by the Commonwealth government, has, it now appears, a certain bearing upon American shipping in the Pacific. The reason for the coal embargo, it may reasonably be assumed, is to facilitate the export of wheat, there being at present something like 135,000,000 bu. in the hands of the Wheat Board, which is held up on account of shortage of tonnage. The interpretation of the coal embargo, according to reliable information, is that a permit for the export of coal will not be given to any vessel that can carry wheat. Recently the 'Ayrian' secured a permit to load coal at the same time that the 'Star of Holland' was definitely refused. These vessels are American sailers, capable of carrying about 3,500 tons dead weight of coal. They had come down from the Pacific Coast of the United States with cargoes of lumber; they desired to proceed with coal to Chile and there load nitrate for San Francisco. It was impossible for the Wheat Board to secure insurance on the 'Ayrian' because it was not tight. The 'Star of Holland,' however, being suitable for carrying wheat, had to proceed to Chile in ballast. This would seem to indicate that only leaky American sailers can expect to load coal and secure a profitable round voyage. It would be a case of the poorest being the best. For the first time in 20 years it is possible to refer to 'American shipping' in these waters. Old sailing vessels, many of small size, have emerged from creeks on the Pacific Coast and are running down to Australia with cargoes of timber. At present there are five such sailers in the port of Melbourne and 12 more are on the way. As a rule, they return to the United States empty, endeavoring to lose no time in picking up another timber cargo at high freight rates."

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 45c. each.

AMALGAMATOR. Joseph H. McNeil, East Saugus, Mass. (U. S. No. 1,182,189; May 9, 1916.)

ANODE SLIMES—Process of Treatment of Anode Slimes and Similar Materials. Francis C. Ryan, Hammond, Ind., assignor of one-half to United States Metals Refining Co., Chrome, N. J. (U. S. No. 1,185,005; May 30, 1916.)

BLASTING—Combined Tamper and Charger. William Frost, Tallula, Ill., assignor to John C. Boeker, Tallula, Ill. (U. S. No. 1,183,290; May 16, 1916.)

CONCENTRATOR. Charles F. Paige, Oakland, Calif., assignor of one-third to Adolph W. Jones and one-sixth to Harry B. De Mooy, Oakland, Calif. (U. S. No. 1,185,129; May 30, 1916.)

CRUSHING—Reduction Mill. Oscar C. Beach, Los Angeles, Calif., assignor to Frederick W. Braun, Los Angeles, Calif. (U. S. No. 1,185,046; May 30, 1916.)

DRILL—Rock Drill. George R. Bennett, Denver, Colo. (U. S. No. 1,183,846; May 23, 1916.)

DRILLS—Improvements in Connection with Rock Drills and the Like. M. T. Taylor and D. A. Loring, Carn Brea, Cornwall, England. (Brit. No. 1,863 of 1915.)

FERROALLOYS—Process of Refining Ferro Metals. Albert E. Greene, Chicago, Ill. (U. S. No. 1,185,396; May 30, 1916.)

FURNACE—Metallurgical Furnace. George L. Danforth, Jr., and Samuel Naismith, South Chicago, Ill. (U. S. No. 1,185,290; May 30, 1916.)

HOISTS—Safety Apparatus for Mine Hoists. Daniel F. Lepley, Connellsville, Penn. (U. S. No. 1,183,306; May 16, 1916.)

INGOT MOLD and Feeder. Bloomfield H. Howard, Aspinwall, and Ernest J. Turner, Pittsburgh, Penn. (U. S. No. 1,182,374; May 9, 1916.)

KIESELGUHR—Composition for Building Materials and Process of Making the Same. Arthur H. Krieger, Los Angeles, Calif., assignor to Kieselguhr Company of America, Los Angeles, Calif. (U. S. No. 1,184,184; May 23, 1916.)

METAL COATING—Method of Applying Protective Coatings to Metallic Articles. Clarence Mark, Evanston, Ill., assignor to Clayton Mark, Chicago, Ill. (U. S. No. 1,184,194; May 23, 1916.)

MINE-CAR RUNNING-GEAR. Warren V. Johnson and Robert C. Kepner, Bloomsburg, Penn., assignors to American Car and Foundry Co., St. Louis, Mo. (U. S. No. 1,183,983; May 23, 1916.)

MINE-CAR WHEELS, Oiler For. Warren V. Johnson, Bloomsburg, Penn., assignor to American Car and Foundry Co., St. Louis, Mo. (U. S. No. 1,183,981; May 23, 1916.)

MINE-CHECK HOLDER. William A. Williams, Barton, Ohio. (U. S. No. 1,182,953; May 16, 1916.)

MINE CHUTES—Safety Device for Mine Chutes. John F. Hume, Redding, Calif. (U. S. No. 1,184,958; May 30, 1916.)

ORE TREATMENT—Treatment of Ores. Frederic A. Eustis, Milton, Mass., and Charles Page Perin, New York, N. Y., assignors to Moa Bay Iron Co. (U. S. No. 1,185,187; May 30, 1916.)

STEEL—Combined Process of Refining Metal and Reducing Ore. Albert E. Greene, Chicago, Ill. (U. S. No. 1,185,397; May 30, 1916.)

STEEL SCRAP—Process of Melting Scrap Metal. Albert E. Greene, Chicago, Ill., assignor to American Electric Smelting and Engineering Co., St. Louis, Mo., a Corporation of Missouri. (U. S. No. 1,185,394; May 30, 1916.)

SULPHUR—Operating Sulphur Wells. William D. Huff, La Fayette, La., assignor of three-fourths to Louise Guidry Moss, New Iberia, La. (U. S. No. 1,184,649; May 23, 1916.)

PERSONALS

C. W. Purington, London, has been re-engaged as consulting engineer to the Lena Goldfields, Ltd., in Siberia.

Mark R. Morgan, of Port Arthur, Ont., has been appointed mining recorder for the Kowkash district, with headquarters at Tashota.

E. Cull Brown, mining engineer, of Los Angeles, is visiting the tungsten camps in San Bernardino and Inyo Counties, California.

N. A. Timmins and John F. Caldwell recently inspected some of the copper and gold properties of the Lake-of-the-Woods district, in Ontario.

Louis Davidson Ricketts, of Bisbee, Ariz., former consulting engineer of Phelps-Dodge interests, was a recent visitor at San Francisco on a pleasure trip with Mrs. Ricketts.

Prof. Edward W. Berry, of the geological department of Johns Hopkins University, will do work in Mississippi and Texas for the U. S. Geological Survey during the coming summer.

Clyde Nye, of New Orleans, **Lloyd Nelson,** of Santa Rita, and **Vere Leasure,** of St. Louis, are the first to graduate from the Texas School of Mines, at El Paso. They were given diplomas last week.

L. F. LeBrun, formerly superintendent of the Jerry Johnson mill, Cripple Creek, has resigned that position to become general superintendent of the Linda Ventura mine, Bluefields, Nicaragua.

Edward L. Stenger has returned from Palevskoy Zavod, Russia, having completed a two years' engagement as mining geologist for the Sissert Mining District Co., Ltd., in the Perm government.

J. Woods, of the U. S. Bureau of Mines and Industrial Accident Commission of California, visited Randsburg in the first half of May and gave lessons in first aid to the miners. Same instruction will be given at Atolia.

At the Reception following the review of the Engineers' Training Battalion at the armory of the 71st Infantry, in New York, were many mining people, among whom were Mr. and Mrs. Karl Eilers, Mr. and Mrs. A. S. Dwight and guests, and Mr. and Mrs. H. W. Hardinge.

P. D. Ahier, who was for a number of years manager of the Idaho Alamo Consolidated Silver Lead Mines, Ltd., in the Slocan district, British Columbia, recently took charge of the Afrati mines and calcination plant of the Anglo-Greek Magnesite Co., Ltd., at Afrati, Greece.

Col. J. J. Penhale took the lead in organizing a Flanders Branch of the Canadian Mining Institute among the members serving at the front with the British forces. There was a dinner on Mar. 2, which is graphically described in the May bulletin of the Canadian Mining Institute.

W. W. Turney, president of Consolidated Virginia Mining Co., **Herman Zadig,** president and otherwise connected with several Comstock companies, and **J. M. Purrington,** secretary of the Chollar and Potosi, all of San Francisco, recently visited the Comstock mines for the purpose of inspection.

Major R. W. Brock has been appointed to organize and command a Western Universities' Battalion. In a recent issue the Victoria "Daily Times" pays a high tribute to Major Brock's ability as an organizer, and remarks that he is one of the most efficient and popular officers in British Columbia.

Robert W. Breadner and James A. Russell, of the Canadian Department of Finance, have been appointed respectively commissioner and assistant commissioner of taxation under the recent act for the taxation of excess business profits. They will be assisted in administering the law by officials appointed in the various provinces.

E. Dulieux, after spending fifteen months at the front as an officer of the French Army, has been appointed a member of the French Government's War Purchasing Commission in New York, and has direction of arrangements for the shipment of all materials purchased for the French engineering service. His address is 25 Broad Street.

E. L. Doheny has retired from the presidency of the California Petroleum Corporation to give his entire attention to the business of the Pan-American Petroleum and Transport Co. and Mexican Petroleum. **Thomas A. O'Donnell,** who has been vice-president and general manager since the organization, has succeeded Mr. Doheny in the presidency.

Adolph Lewisohn, president of the Hebrew Sheltering Guardians Society, has given $20,000 for the purpose of furnishing another cottage for the institution, which now has 638 children in cottages, under a plan which has proved eminently successful. This institution is one of the most progressive of all of the child-caring institutions in the country.

Prof. William Bullock Clark, head of the department of geology at Johns Hopkins University, and state geologist of Maryland, has been appointed by the Chamber of Commerce of the United States a member of a committee of five to discuss with the representatives of organized labor a modification of the anti-trust laws by which coöperative agreements under the regulation of the Federal Trade Commission might be allowed in those industries dealing with the primary natural resources.

Edwin E. White, of Ishpeming, Mich., has resigned his position as chief geologist with the Cleveland-Cliffs Iron Co. and will leave June 10 for India, to accept a similar place with the Tata Iron and Steel Co. He will make his headquarters at Sakchi, near where the company's mines are situated. Mr. White was with the Cleveland-Cliffs as chief geologist for seven years and brought the department to a high state of efficiency. His successor has not yet been announced.

David H. Browne received the degree of doctor of laws from Queens University, Apr. 26. In mentioning this the editor of the monthly bulletin of the Canadian Mining Institute remarked correctly that Mr. Browne is not only a distinguished metallurgist, but is also a humanitarian, a scholar, and a wit. He has shown a keen and practical interest in educational matters, and has been ready at all times to befriend the younger members of the profession who have sought his advice or assistance.

T. M. Denis, provincial superintendent of mines of Quebec, was called to the colors by the French Government in April last. When nine years of age he came to Canada, and although, since then, 35 years have passed in which he has had no opportunity to visit France, his name has been maintained on the roll of French reservists. Mr. Denis sailed from New York for France on Apr. 22. Both the Dominion and the Quebec governments have made application to the French War Office asking that he be permitted to return immediately.

Fred B. Close, who has been in charge of the exploration and development operations at the White Pine Extension, Michigan, as superintendent, has resigned his position and is succeeded by **William R. Bolley,** who has been engineer at the property for the past year. Mr. Close was in charge of the original explorations undertaken by the Smith interests, of Detroit. Mr. Bolley was employed by the Copper Range mines before going with the White Pine Extension. Mr. Close will continue in direction of other explorations he is conducting in the White Pine district.

OBITUARY

Charles Bacigalupi died at Newton, Eldorado County, Calif., on May 15 at the age of 72 years. He went to California in the early days and engaged in placer mining; he was one of the pioneers in hydraulic practice.

Edward August MacDonald died at Green Valley, Eldorado County, Calif., on May 11 at the age of 89 years. He was one of the pioneers, going to California in 1852 and engaged in mining. He had been a resident of Eldorado County for 69 years.

Charles Grimes, mining capitalist and operator, until recently general manager and controlling factor of the Tom Reed mine, at Oatman, Ariz., was found dead May 23 in his room in Kingman, Ariz. His body was shipped to his home in Pasadena, Calif., for burial.

Capt. W. H. McClintock died at Sonora, Tuolumne County, Calif., on May 23 aged 62 years. He was born in Sacramento and was engaged in mining in Tuolumne County; a number of years ago he was associated with the Don Pedro Gold Mining Co., operating on the Don Pedro Bar.

Charles Sweeny died at Portland, Ore., May 30. He was born in New York, 1849; fought in the Civil War, then went to California and later to Nevada and was engaged in mining on the Comstock. He was severely injured in the fire in the Belcher and after that went to Portland and was one of the organizers of the Merchants' Exchange. He moved to Spokane in 1883 and later became interested in mining in the Coeur d'Alenes, where he operated extensively. He was instrumental in consolidating several mines into the Federal Mining and Smelting Co., and was a director in several other companies. He was well known in the West and in New York. He leaves three sons and two daughters.

Editorial Correspondence

SAN FRANCISCO—May 31

The Last Chance District in Placer County is becoming more active. At the Pacific mine, 25 men are now employed and the property is making a good showing. The Glenn mine has cut the channel and expects soon to be producing pay gravel. The Home Ticket mine, operated by D. M. Day, is employing about 20 men. While the snow has been melting fast during the warm weather, the road from Auburn to Last Chance will not be opened before the middle of July. There was 8 ft. of snow last winter, which is 3 ft. more than normal.

The Shell Co., a New York corporation, has conveyed to the Shell Co. of California property approximating $375,000 in value, situated in the Counties of Alameda, Contra Costa, Fresno, Napa, Sacramento, San Mateo, Santa Clara, Santa Cruz, San Joaquin, Solano, Sonoma, Stanislaus and San Francisco. The land in Contra Costa County is used as site for refining plant, etc., that in San Francisco for shipping terminal, and in the other counties some of the land is for pipe line or delivery stations and some of it includes oil lands. The Shell Co. of California is becoming strongly established in the oil industry and is one of the large marketing concerns.

The Rittman Process is being introduced in California by Dr. David T. Day, who has recently returned from the San Joaquin field, where he went with Doctor Rittman to explain the process to independent oil producers. The Standard Oil Co. has so far declined to adopt the process, holding that its own methods of refining are fully sufficient. The idea, held by some, that the adoption of the Rittman process by independent producers in California will cause an immediate reduction in the price of gasoline is merely a supposition, based upon the notion that the process will be speedily adopted and be successful in increasing the production of gasoline at a lower cost than present methods.

The Smoke-Belt Farmers in Calaveras and Amador Counties are prosecuting their suit against the Penn Mining Co., operating the copper mines at Campo Seco. Damages aggregating about $200,000 are alleged to have resulted from fumes from the smeltery. The suit is before a jury in the United States District Court in San Francisco. Judge W. C. Van Fleet voluntarily disqualified himself and Judge Frank H. Rudkin, of Spokane, is sitting in the trial. This aggregation of complaints from 30 farmers has been pending for about two years. The facts regarding this suit have been told in the "Journal" and need only to be briefly referred to here. The farmers did not bring these suits voluntarily, but at the solicitation of a firm of attorneys in San Francisco who are reported to have offered to stand the expense and divide the spoils. Some of these farmers are reported to have declared upon being appealed to that they had no complaint to make against the Penn Mining Co., but were willing to take a chance so long as the attorneys were paying the bills. Copper smelters have been making money with the high price for copper and no doubt the attorneys will be anxious to have these suits speedily tried so that if there is a favorable verdict it may be collected while the price of copper is still sufficient to enable the Penn Mining Co. to pay the damages.

Industrial Accident Statistics for 1915, and comparative figures for 1914, have been issued by the state commission, showing that in 1915, 533 persons died from accidents in California, a reduction of 158 from 1914. The report shows that 71 deaths occurred in the mining and quarrying industries in 1915 and 86 in 1914. The commission regards this improvement as a result of the careful planning of the work of the safety departments. The commission issues a monthly bulletin containing news regarding compensation insurance. It is shown that the refund to policyholders for the years 1914-1915 amounts to $165,000 and promises further substantial refunds when legal reserves have been released. The financial report shows that the state insurance fund writes the largest compensation-insurance business in the state, having increased its lead over the nearest competitor to more than $250,000. The report claims that state capitalization has forced rate reductions and adds that new rates soon to be published will "show a revision which is principally downward." This is an interesting statement in view of the fact that so far as the mine-employees insurance is concerned, the California Metal Producers Association had a lively discussion over the high state rate, obtained a low rate from the regular companies and was really the means of forcing the state insurance fund to reduce its own rates.

DENVER—June 1

The Old Mining Town of Georgetown, in upper Clear Creek County, formerly produced largely of lead-silver ores; since silver's demonetization, mining in the district has been desultory but with the new prices prevailing for silver and lead as well as for copper and zinc, which occur as associated metals in the ores, the old camp is becoming decidedly active. Among the mines most active at present are the Seven-Thirty, Burleigh Tunnel, Onondaga, Capitol, Santiago and Whale—all mines that were famous years ago. Operations at the Colorado Central are being carried on by a group of men comprising C. L. Woods, Edward S. Wiard, C. C. Worland, Harry W. Robinson, L. D. Welch and Tallmadge Kyner; although a company was formed, it is a close corporation.

Prosperity in Colorado Metal Mining has again become a conspicuous fact. Throughout the districts of the state, wages are being voluntarily raised by operators, although there is not the slightest indication of labor unrest. This apparent generosity is because metal miners are scarce this year. The dullness in mining here for the past few years obliged many miners to either move to other states or to undertake new occupations, with the result that this sudden revival in mining in all the older camps, together with the excitement in the tungsten areas, has placed a premium on experienced mine labor. Since it was chiefly gold mining that continued active during the depression, those miners who remained at their trade in Colorado drifted to the gold districts like Cripple Creek and Telluride. Mining companies, anxious to benefit by the attractive prices for silver, zinc and lead, have been prevented from operating at desired magnitudes because of this shortage of men and they have, here and there, figured out new wage scales to secure miners from the gold camps. New schedules of wages will be in effect today in most of the districts of the state, increases being based upon existing metal prices and in the nature of profit sharing. The increases will vary from former wages by from 7 to 15%. There does not appear to be any concerted action between the operators. Schedules differ in the various districts as well as at different mines in the same district. The average raise in the San Juan region is about 30c. per shift so long as silver remains above 65c. per oz. In some districts, zinc miners will receive 8 to 10% more than heretofore. At the Mary Murphy mine, which produces complex ore, a raise of 50c. per day is given all men who have been receiving more than $3.50 per shift, while 25c. per shift is added to the wages of those men who have received $3.50 or less. If spelter should fall below $10 or lead below $6, these bonuses will be halved. In some camps a flat raise of 25c. per shift is announced for all classes of mine labor.

BUTTE, MONT.—June 1

Labor Troubles are again to the fore owing to the demand of the Workingmen's Union and the Teamsters' Union for an advance in wages from $3.50 to $4 per day, to take effect on June 1 and June 12, respectively. The demand has been refused by the Silver Bow Employers Association which includes the mining companies, merchants, etc. Union leaders, pretending to speak for their followers, thereupon declared that they will get the raise or tie up the town. At the present writing no announcement has been made as to whether or not the men will go on strike in case the employers insist on their refusal to recognize the demand.

The Wickes-Corbin District is now active. The Boston & Corbin company, operating Bertha and adjoining properties near Corbin, has finished unwatering mine, and stoping and shipping will be resumed at once to take advantage of high price of copper and silver. Mount Washington mine, 3 mi. from Wickes, is shipping from 50 to 60 tons of rich silver ore daily and doing large amount of development work to block out ore. The L & C claims in Lump gulch have been taken under lease and bond by a syndicate of Butte men for a consideration, said to be $20,000; the mine is 8 mi. south of Helena in district formerly known as a large producer of rich silver ore; new management expects to begin development work immediately.

SEATTLE, WASH.—May 31

Copper Production in Alaska in 1916 will exceed all previous records. Kennecott's Alaska properties are now producing at the rate of about 10,500,000 lb. monthly; the milling facilities both on Latouche Island and at Kennecott are being increased; at the Beatson mine on Latouche Island, the milling capacity, now about 600 tons daily, will gradually be brought up to 1,000 tons by the end of the season; at Kennecott the company is planning to double its present capacity of 750 tons, and high-grade crude ore is also being shipped from both properties. An interesting metallurgical development at Kennecott is the new ammonia leaching plant which has brought the copper extraction at Kennecott up to about 95%; the leaching plant is treating the concentrator tailings, recovering the carbonates that formerly went to waste in the gravity-concentration process. There is considerable activity among the smaller copper mines of Alaska this year and, with the prevailing high prices, many prospects are shipping selected ore from their development operations.

SALT LAKE CITY—June 2

The Judgment Against Ohio Copper may be bought in by a new company, to be formed by the principal bondholders. The Ohio Copper Co. was declared bankrupt some time ago, and a receiver appointed to wind up its affairs. Foreclosure proceedings were brought by bondholders and a hearing was held in Salt Lake in March. The bondholders received judgment for the whole amount of the bonds, $1,242,000. The property will be sold to satisfy the judgment, and it is probable will be taken over by the proposed company of bondholders. At present, the property is being worked by the General Exploration Co., the lessees having already paid royalties of approximately $200,000.

The Electrolytic Zinc Plant at the Murray works of the American Smelting and Refining Co., has been in operation since about the first of the year. It is, however, only an experimental plant, and is designed to assist the lead plant by eliminating the zinc from some of the lead-zinc ores. While the zinc plant is doing excellent work in relieving the lead furnaces of a zinky charge and making their operation much easier, it has not yet been determined that the present type of treatment plant for the zinkiferous ores will be permanently adopted, as experiments in this connection are still being continued. From the announcement that the American Smelting and Refining Co. had under construction an electrolytic zinc plant, many had assumed that this might approach in size the great works now being erected by the Anaconda Copper Mining Co. at Great Falls, Mont., but this is not the case. The company's plans have not matured in this respect, and furthermore the present supply of zinc ores at Salt Lake does not warrant the erection of a plant of the size Anaconda is building.

Judge Mining and Smelting Co. is the name of the reorganized Daly-Judge Mining Co., of Park City. The original authorized capital of the former Daly-Judge was 150,000 shares. In May, 1902, the capitalization was increased to 300,000 shares, par value $1, and in March, 1916, a further increase to 500,000 shares of the same par value was made. A part of the increase was offered to stockholders at $6 a share pro rata, and the remainder at $8. Enough stock was offered at $6 to be absolutely sure it would be taken, and sufficient funds collected to enable the company to construct its new zinc plant near Park City, leaving in the treasury ample reserves to continue dividends at the present rate of 25c. a share quarterly. At the annual meeting in Jersey City, the old board of directors was reëlected as follows: H. Otto Hanke, president; Moylan C. Fox, vice-president; George W. Lambourne, secretary, treasurer and general manager; William M. Bradley and A. C. Wall, additional directors. The company is in the best financial condition in its history, having quick assets of $700,000 and over $1,000,000 available for construction of the new electrolytic zinc plant.

ELY, NEV.—June 1

Nevada Consolidated has generally been misunderstood. There has been an idea that it had nothing but delimited and short-lived orebodies. On the contrary, the new drilling, from year to year, has increased the tonnage. Even during the month of April there were 8,500 ft. of prospecting drilling done. One hole showed an important thickness of 4% ore. Mining and milling tests on 250,000-ton lots of ore have shown that good profit can be made on ore assaying 1% copper. Drill holes in the bottom of the Eureka pit show nearly 500 ft. of 1% ore.

The cost of timbering in the Ruth mine is extraordinarily heavy, the ground swelling in such a way as to crush 12-in. sets in three days in some places. The management is now adopting a sort of gloryhole method of mining. Plans have been put up to the main office to drive a long transportation tunnel, getting nearly 500-ft. depth below the bottom of the Eureka pit and of the Ruth mine, and to extract the low-grade ores by gloryhole mining.

The company has decided to spend $400,000 at the concentrating mill, abandon the old trestle, which is in rather bad condition, run around on the hill, obtaining the proper elevation, erect new crushers and enlarge generally, with the idea of increasing the milling capacity to 16,000 tons, perhaps 18,000 tons, of ore per day. Recently the present mill put through 15,000 tons of 2% ore in one day, saving about 75% of the copper.

JOPLIN—June 3

Labor Troubles are threatening again in this district, but it appears today that they will be of short duration. The average base price of zinc ore for April was between $100 and $110, but for May it dropped to between $80 and $90. As prices went up operators increased wages at the rate of 25c. a day for each $10 raise, but when they announced a 50c. cut in conformance with the lower ore price, they were notified by the Brotherhood of Hoister Engineers that the cut would not be permitted. At most mines, the reduced wages went into effect Saturday morning, June 3, and about one-fourth of the mines were shut down as a result of a walkout of hoistermen. Under the wage schedule the hoistermen drew $4.75 per day when ore was between $100 and $110, and instead of permitting a cut to $4.25 they want $5 a day. At the Kirkwood mine, south of Carterville, there was a free-for-all fight between about 50 men calling themselves strikers and an equal number of shovelers and machine men who had been pulled from the ground and ordered to quit work. Several were injured but none dangerously. A number of hoistermen have informed their employers they would be ready to go back to work Monday at the reduced wages.

HOUGHTON, MICH.—June 1

The Calumet & Hecla Leaching Plant will be in operation by July 15 or possibly before that date, if present plans carry. Advance experiments, covering a period of several years, indicate that the amount of copper that will get away in the tailings from the mill and regrinding plants and leaching plant will be limited. Eventually it is hoped that less than 3 lb. of copper per ton of rock can escape. What the rich conglomerate now yields per ton of rock handled—about 30 lb.—was an average loss in the mills in the early days when the rock was running 100 lb. to the ton.

DULUTH, MINN.—June 3

Minnesota's Largest Taxpayer, the U. S. Steel Corporation, on May 31 paid $2,290,614.06 to the county treasurer of St. Louis County, being taxes for first half of 1915. The sum was divided as follows: Active mines, $1,539,001; inactive mines, $723,118; Duluth plant, $23,666; miscellaneous, $4,829.

The First Consignment of the 1,000 steel ore cars ordered by the Duluth, Missabe & Northern Ry., has arrived. Eight locomotives of a new and powerful type are also en route. A new record in ore hauling will be made by the road this season. An average of 35 trainloads of ore is being handled daily at the Proctor yards, being 10 more than the average in rush times last season.

Higgins Land Co. Decision in the district court at Duluth requires the company to pay William J. Wallace $15,000 for services in the readjustment of the company's mining lease with the Steel Corporation. Spencer & Marshall, Duluth, attorneys, secured a verdict for $103,000 from the company some time ago for services in the same matter, and one Frank A. Barber sued for $50,000 but settled out of court. All of which indicates that the company must have secured an exceedingly valuable readjustment with the Steel Corporation.

TORONTO—June 3

A Bill to Assist Prospectors in the building of trails, roads and bridges has been introduced into the British Columbian Legislature by Hon. Lorne A. Campbell, minister of mines. The Mines Development Act provides, among other things, for the payment to miners of 50% of the cost of roads, bridges, etc., after same have been inspected and the construction approved by the provincial engineers.

Investigation of Northern Ontario Mineral Regions has been undertaken by the Ontario Bureau of Mines. Ellis Thomson has been detailed to examine the gold area south of Dryden, to which attention has recently been directed by the Rognon discovery. Percy E. Hopkins, assistant provincial geologist, and party will make a further investigation of the Kowkash area. Prof. M. B. Baker, of Kingston, will examine the neighborhood of the Long Lake gold mines and the serpentine area in Dundonald Township, on the Temiskaming & Northern Ontario Ry. Prof. A. L. Parsons is investigating molybdenite outcrops in different localities throughout the province.

The Mining News

ALASKA

RICH GRAVEL found on Michigan Creek, by L. J. Johnson, Walter Johnson and Frank Solly. Creek is tributary of Good Paster River in Tanana recording precinct; gravel only 10 to 12 ft. deep.

SEA COAST MINING CO. (Valdez)—This gold property at Shoup's Bay being examined by C. Bergstrom preparatory to development. C. Christopher, president.

ALASKA MEXICAN (Treadwell)—In April, crushed 12,880 tons; yield, $20,095; operating expenses, $22,185; operating loss, $2,089; construction $3,232; yield per ton, $1.58.

ALASKA UNITED (Treadwell)—In April, crushed in Ready Bullion mill 24,220 tons, in 700-Ft. Claim mill 18,270 tons; yield $54,293 and $29,239; operating expenses $31,368 and $38,505; profit, $22,925; loss, $9,266; construction $3,906 and $2,987; yield per ton, $2.26 and $1.61.

ALASKA TREADWELL (Treadwell)—Crushed in April, 77,991 tons; yield, $132,908; operating expenses, $97,607; operating profit, $35,300; construction, $10,462; yield per ton, $1.72. Company's proportion of "Central and Combination Development," undertaken in connection with the Mexican and United companies, included in operating expenses.

ARIZONA

Cochise County

COPPER QUEEN (Douglas)—Starting smeltery enlargements including two new convertors and additional roasters.

CALUMET & ARIZONA (Douglas)—Roasters and two additional reverberatory furnaces being erected. Power house being enlarged.

MASCOTT COPPER (Mascott)—Gold ore valued at $70 a ton struck on 100-ft. level; orebody on 150-ft. level traced 200 ft. to surface.

CENTURION (Wilcox) — New hoisting equipment and pumps being installed; development to be resumed soon; J. P. Richardson president.

LEADVILLE (Courtland)—Optioned to U. S. Smelting, Refining and Mining Co. for $600,000 according to F. B. Weeks, examining engineer of U. S. company.

GOLDEN RULE (Manzora)—High-grade gold-lead ore encountered; 20-stamp mill being put in shape for operation; installation of 50-ton crusher and additional equipment to enable mill to treat custom ore being considered.

Gila County

HUGH DAGGS, of Phoenix, thinks he has low-grade copper deposit at Payson, similar in extent to Ray. Zone about ½ mi. wide by 6 mi. long, contains 70-ft. porphyry dike, ½ mi. long, in center of which runs 7-ft. ledge, from which copper glance has been taken; valuable only as a low-grade operation; may be prospected with churn drills.

INSPIRATION-NEEDLES COPPER CO. (Miami) — This company being reorganized; will develop property in Live Oak Cañon by drilling. Dan R. Williamson, president. H. C. Malloy will be in charge.

Mohave County

THE ENTIRE CERBAT RANGE is active owing to high price of silver and base metals, as well as to important developments at depth in Golconda and Tennessee mines. This range has commercial deposits of nearly every metal mined in the United States.

MIDNIGHT (Chloride)—"Jewelry" gold ore found in crosscut on 200-ft. level.

SCHEELITE (Yucca)—J. F. Miller has 6-ft. vein scheelite ore, samples of which run 28% tungstic acid.

TIMES (Oatman)—Mill ore reported in crosscut tunnel. No assays available. Devoting attention to sinking shaft to 300-ft. level.

TOM REED (Oatman)—On 575-ft. level of Black Eagle shaft, ore has been opened in drift for over 60 ft.; average value about $10.

TENNESSEE (Chloride)—Working over old dump; higher recoveries possible through small flotation plant at concentrator at Needles, Calif. Waste of former times is now ore.

WALNUT CREEK MINING AND MILLING CO. (Los Angeles, Calif.)—Permitted to sell 66,585 shares at 35c. for prospecting 10 copper-bearing quartz claims in Maynard mining district.

BIG JIM (Oatman)—Now has its electrical machinery in operation; current from Desert Power Co.'s plant in Kingman. Drifting on the 400- and 500-ft. levels. Oreshoot not yet opened to full extent in either direction.

GOLD ORE MINING CO. (Goldroad)—Shipping about 25 tons of $25 to $30 ore daily to Gold Road mill. Approximately 1,000 tons of ore broken in stope recently started. Aside from the United Eastern, Gold Road and Tom Reed, this mine probably has more ore developed than any other property in district.

ARGO MINES CO. (Oatman)—Shaft down 533 ft. An average of 6 ft. per day made in sinking for last 16 days, working three shifts with Jackhamer drills. In driving crosscut on 400-ft. level, mostly in rhyolite, 280 ft. was made with Jackhamer drills in 27 days, working three shifts. This is probably best record for sinking and drifting in district.

OATMAN COMBINATION (Oatman)—Shaft down about 325 ft. At 100 ft. passed through vein about 7 ft. wide that averaged $3 per ton. Now sinking in footwall andesite and will not do lateral work until 500-ft. level is reached. Equipped with 15-hp. Fairbanks-Morse gasoline hoist, 180-ft. electric-driven Sullivan compressor, Jackhamer drills, etc. Efficient management; during last three months road built 1,500 ft., equipment installed, and shaft sunk to present depth.

Pima County

NEW ATLAS MINES (Silver Bell)—Recently made third important strike.

PROVINCIA (Tucson)—Situated in Sierrita Mountains; sold to W. C. Abbott and Stanford Williams. Specimens from surface asayed 40% copper and 50 oz. silver; shaft will probably be sunk.

PIONEER SMELTERY (Sahuarita)—Companies operating in Twin Buttes district plan to purchase and reopen. Capacity to be increased to 500 tons daily. Projected railroad from San Xavier district to Mineral Hill and Paymaster districts will furnish considerable tonnage.

COWBOY MINING AND SMELTING (Twin Buttes)—J. R. McGee, B. F. Daniel, H. E. Farr, A. D. Le Baron and S. E. Brown are officers of new corporation acquiring 74 claims, 6 mi. southwest of Tucson, formerly belonging to J. R. McGee. A 200-ft. tunnel shows complex sulphide ore, carrying copper, gold, silver, lead, zinc and molybdenum.

Yavapai County

NEW YORK SYNDICATE reported to have taken over War Eagle, Gladiator, Wild Flower, Crown King and old Tiger groups in Bradshaw Mountains.

OCTAVE (Congress)—Winze from tunnel on 300-ft. level of new shaft on Little Joker claim in high-grade ore; 1,000 ft. distant from rich old workings.

SHEA COPPER (Jerome)—Has ordered churn drill; D. J. Shea, president, and J. P. Connolly, secretary-treasurer, both of Jerome. Mine adjoins Copper Chief.

RICHINBAR (Richinbar)—Reported that this old group of gold properties in Black Cañon will be reopened. Plans include modern mill and road to railway.

JEROME VERDE (Jerome)—Development plans changed; instead of sinking new shaft, will deepen old Columbia shaft, now down 725 ft. New hoist and compressor to be installed.

CALIFORNIA

Amador County

AMADOR STAR (Plymouth)—Reported 4 ft. good ore disclosed in new shaft at vertical depth of 227 ft. Shaft is 200 ft. south of tunnel. Baylies C. Clark, Sutter Creek, superintendent.

CENTRAL EUREKA (Sutter Creek)—C. E. Julihn making examination for company. Reported that mine has prospect for more orebodies below the 3,200 level. Directors decided to levy assessment of 5c. per share for development. Central Eureka is situated south and adjoining the Old Eureka and is joined by the South Eureka on the south. Equipped with 40-stamp mill. J. A. Davis, superintendent.

Butte County

MAGALIA has been visited by a number of engineers looking for mines during the last month. The unusual activity is causing renewed attention to this famous old district.

YANKEE HILL (Quartz)—Under bond to W. F. Anderson and associates who will operate.

ORO FINO (Drift)—W. F. Anderson and partners, owners, are in pay gravel. Formerly large producer.

THOMPSON (Drift)—Under bond to G. C. Allen and associates of Chico; sinking an incline to tap ancient channel.

J. F. LITTLEFIELD, representing Sutro interests, is driving on channel adjoining the Eureka on Little Butte Creek.

WILLARD (Quartz)—This Red Hill mine, famous for third largest nugget in California, purchased by W. E. Young and associates of San Francisco. Idle for 20 years. On west branch of Feather River.

LUCKY JOHN (Drift)—Owned by J. D. Hubbard and associates of San Francisco. Will be worked through main tunnel 900 ft. long and raise of 96 ft. to gravel. Washing operations will commence in about two months. Adjoins the Mineral Slide, which may also be opened.

Calaveras County

CALAVERAS CONSOLIDATED (Carson Hill)—This property and others adjoining the Melones have been optioned by W. J. Loring, manager of the Dutch-Sweeney-App, to explore the large bodies of low-grade ore.

Inyo County

TUNGSTEN CAMP is advancing rapidly in the installation of electric power and treatment plants. Manager Stevens, of Tungsten company, stated that power had been guaranteed by Nevada-California Power Co., by May 29; mill progressing; will occupy space 70x147 ft. and is to be ready in 60 days; two 38,000-lb. Anaconda type rolls have been delivered by team from the railroad at Laws. Reported Aëroplane ledge proved for nearly 40 ft. Little Sister lower tunnel is in 125 ft.; second tunnel started 100 ft. vertically nearer surface. Munzinger & Gibson found new tungsten deposit in cañon south of Bishop Creek Cañon.

Kern County

YELLOW ASTER (Randsburg)—The 100-stamp mill crushing 500 tons ore per day. Recovery by amalgamation in excess of $35,000 per month. Company contemplates dry screening plant to eliminate coarse waste before reaching stamps.

Nevada County

UNION (Nevada City)—Mine unwatered and cleaning out lower workings started. Large amount of mud and silt in the bottom of shaft and drifts.

EMPIRE-PENNSYLVANIA (Grass Valley)—Sixty stamps at the Empire and 20 at the Pennsylvania dropping on quartz from 4,800 level, said to be high-grade. New productive territory developed. Monthly production about $125,000.

San Bernardino County

IN ATOLIA, it is reported that about 100 men have been laid off and the East Union and Barr mines closed, because of sharp break in tungsten prices and unsatisfactory showing in lower workings.

ATOLIA (Atolia)—D. Gretto, miner working in No. 1 shaft, had back broken and has been placed in plaster cast; while riding in skip, head struck timber and he was bent backward over skip and fell 20 ft.

Trinity County

WEAVERVILLE DISTRICT is active, water for hydraulicking being abundant. La Grange and Union Hill mines working full forces. Large amount of machinery being hauled through Weaverville to Heurtevant mine, 40 mi. below Junction City, where a dredge is being built by Valdor Mining Co.

TRINITY DEVELOPMENT CO. (San Francisco)—Authorized by Corporation Commission to issue $93,000 bonds to Trinity Exploration Co. in payment of balance of purchase price of approximately 200 acres dredging land. Company also permitted to issue 1,994 shares to E. A. Wiltsee, Herbert Fleishhacker, John MacGinnis and Frank W. Griffin.

COLORADO

Clear Creek and Gilpin Counties

MASCOTTE (Georgetown)—Car of high-grade gold-silver ore assaying well in lead and copper shipped recently.

ONONDAGA (Georgetown)—Car of ore being shipped daily. Stope 70 ft. long opened on 180-ft. level; vein 20 in. wide.

KITTY OUSLEY (Georgetown)—Imperial Mining Co., has given a lease on this property and active mining has begun.

IMPERIAL (Georgetown)—Smelter returns on two cars of gold-silver-copper ore shipped recently gave $137 per ton.

RED OAK (Georgetown)—Workings will be cleaned out and retimbered. Raise connection between Sceptre and Sunburst adits will be made.

AETNA (Georgetown)—This Griffith Mountain property being developed by Richard Kane. A 10-in. vein opened assaying 45% lead and 40 oz. silver.

ESPERANZA (Georgetown)—Development of this Columbia Mountain property resumed by L. Lucas. Vein of high-grade ore opened in main tunnel.

LINCOLN MINES CO. (Idaho Springs)—Charles Orpin and associates, of Denver, have been given lease on Uncle Sam vein and will develop actively through Big Five tunnel. Company will also carry on development. H. A. Wimbush, president.

Lake County

LITTLE SILVER (Leadville)—This Fryer Hill property recently unwatered and work begun on 240-ft. level. J. B. McDonald in charge.

Ouray County

CAMP BIRD (Ouray)—Milled in April 1,389 tons; profit £5,400.

ST. PAUL (Red Mountain)—Oreshoot carrying gold, silver and copper recently opened by lessees in crosscut from 500-ft. level. Ore in district occurs in chimneys, and it is stated that shaft was sunk alongside hard-rock casing of oreshoot now broken into.

Summit County

PLACER-GOLD RECOVERY at Breckenridge by two Tonopah dredges and French Gulch dredge $45,000 to $50,000 per month.

HAMILTON (Breckenridge)—Mine in Summit Gulch will be reöpened. Mill equipped with stamps, plates and concentrating tables.

OLD UNION (Breckenridge)—New shaft being sunk in French Creek valley opened good-grade lead ore. Shaft equipped with No. 9 Cameron pump; more water expected when shaft goes below creek level. Mill overhauled; will treat ore mined in main-tunnel workings. Property operated by Colorado Ore Salvage Co.

IDAHO

Owyhee County

NORTH STAR AND TRIUMPH (Hailey)—These old mines, on East Fork, in Wood River district, optioned to Federal Mining and Smelting Co., of Wallace. Considerable ore is blocked out but development will be continued pending the designing and erection of a mill suited to the complex silver-lead-zinc ores.

Shoshone County

CONSOLIDATED INTERSTATE-CALLAHAN (Wallace)—Profits for first quarter, 1916, were $823,323; operating costs, $207,117; mined 29,897 tons; milled 26,514; shipped ore and concentrates, 17,132; zinc recovery, 88%; total costs, $7.06 per ton mined.

ILLINOIS

IROQUOIS IRON (Chicago)—Option held by C. D. Caldwell and C. T. Boynton reported exercised. Company has four blast furnaces at South Chicago. Rumored that Iroquois, Federal, Byproducts Coke Corporation and Mark Manufacturing Co. may form basis of new consolidation.

MICHIGAN

Copper

WOLVERINE (Kearsarge)—May output reduced last week of month by railroad washout.

WHITE PINE EXTENSION (Ontonagon)—Shaft now down 60 ft. Clearing ground for cottages.

MOHAWK (Mohawk)—No ore shipped from any shaft, May 26 to June 1, account washout of railroad tracks.

CASS COPPER CO. (Ontonagon)—Diamond drilling will commence at once on old Norwich property, in which James MacNaughton, of Calumet, and others are interested.

TAMARACK (Calumet)—Godfrey M. Hyams has brought suit at Grand Rapids to restrain sale to Calumet & Hecla. Sale date may be voluntarily extended beyond July 1.

ADVENTURE (Greenland)—Mill is in fairly good condition, but reopening of mine, idle nine years, will require at least 60 days. No. 3 shaft will be retimbered for 80 ft. and new pipe column will be necessary.

Iron

W. H. SMITH, representative of Henry Ford, of Detroit, inspected mines of Crystal Falls and Iron River districts.

ROLLING MILL (Negaunee)—Has shipped from pockets and from stock 50,000 tons of ore thus far this year.

SPIES (Iron River)—Shaft bottomed; drifts now being extended to ore. All mine buildings and dwellings completed. Some ore will probably be shipped in the fall.

INDIANA (Iron Mountain)—Stripping completed and underground mining will be discontinued. Ore milled and hauled to surface through old shaft. Shipments from stockpile started to Thomas Furnace Co., Milwaukee, Wis.

NORTH LAKE (Ishpeming)—Stripping completed on Sec. 6 property. Ore being mined with steam shovel. About 20 ft. of ore will be mined thus and the remainder milled. Drifts have been run under deposit from Morris mine.

NORTH TRADERS (Iron Mountain)—J. T. Spenser sold three-quarter interest to E. N. Breitung & Co. Work this year disclosed siliceous iron ore. Part of property will be stripped and mined by shovels. Shaft will be put down 125 ft. to reach remainder of deposit which adjoins Antoine Ore Co. on north.

MINNESOTA

Cuyuna Range

CUYUNA-SULTANA (Ironton)—Equipment for No. 2 shaft to be delivered by June 15. New dry house completed and office building under construction.

CUYUNA-MILLE LACS (Ironton)—Drift toward new No. 3 shaft disclosed orebody hitherto unknown. Management may strip the principal deposit; overburden 50 to 75 ft. in depth.

RIEDER IRON CO (Duluth)—Organized to explore Cuyuna Range lands. Drilling will be started on S½, NW¼, Sec. 7, 45-29, immediately northeast of Wilcox mine. President, W. A. Hicken, Duluth, Minn.

Mesabi Range

AGNEW (Hibbing)—Opened in May, after 1½ years' idleness, has small shovel at bottom of pit loading ore into tram cars; ore hoisted through shaft.

TIOGA (Chisholm)—Machinery for washing plant being installed, includes one 10-ft. cylindrical screen and one 25-ft. log washer, placed directly below shaft house. One shovel now stripping part of the property; Winston & Dear of Hibbing have the contract.

Vermilion Range

NORTH CHANDLER (Ely)—Entire underground force struck May 22 for increase of 25c. per day, from $2.55 to $2.80. Rate is 25c. less than present Steel Corporation rate.

V. DURRELL IRON MINING CO.—New corporation organized to explore three 40-acre tracts; one known as the McDonald Forty, in Sec. 30, 63-11, will be developed by shaft. Incorporators are H. P. Durrell, F. W. Farnsworth and W. C. Hatcerley, of Cincinnati, Ohio, and Edward Lynch of Duluth. Property held under lease; fee owned by A. M. Chisholm and others of Duluth.

MISSOURI

Joplin District

GARDNER (Aurora)—New mill on United Zinc Co.'s land completed.

SMITH-HODGES (Wentworth)—Purchased Blue Bell mill. Will enlarge.

MILAN (Carterville)—Closed temporarily for repairs. New sludge plant being added.

PEACOCK (Peacock)—Three centrifugal pumps, electrically driven, started draining.

OSAGE (Baxter)—Will build mill on tract east of Cardin where recent drilling indicated good orebody.

STATE LINE (Commerce)—Good strikes made on tract on Kansas-Oklahoma line north of Commerce. Will build mill.

NATIONAL (Prosperity)—Rich strike in drill hole on new lease near Coyne mines. Will do more drilling and may erect another mill.

WALLOWER (Joplin)—Has begun new 350-ton plant to replace one destroyed by fire at Prosperity. Will be electrically operated.

McCLELLAND (Joplin)—Building new plant at Chitwood on virgin tract. One shaft down, another being started, to reach disseminated formation at 180 ft.

CHURCH (Commerce)—Dyke, Heffernan, Henault and Plump have richest hand jig operation in district on Church lease near Cardin. With only four jigs, made two carloads of high-grade concentrates in two weeks after breaking into ore in shaft at 160 ft. Will install more jigs.

MONTANA

Beaverhead County

ORIGINAL BANNACK MINING CO. (Bannack)—New air compressor, gasoline hoist and accessories being installed. On Pioneer claim, oreshoot 1,800 ft. long estimated to contain ore averaging $11 in copper and gold. Shaft to be sunk 300 ft. to explore orebodies.

Cascade County

ANACONDA (Great Falls)—First unit electrolytic zinc refinery expected to be ready in September if there is no delay in getting electrical equipment from General Electric Co.; buildings completed and electrolytic tanks now being installed. Company preparing zinc mines at Butte for 2,000-ton output, which will be concentrated at Anaconda and products sent to Great Falls for refining. Emma mine practically ready for production from 800 level and above; crosscut from 1,600 level of Gagnon mine is being driven toward Emma; new hoist installed and sinking from 800 level will soon be begun. Douglas mine, 12 mi. from Pine Creek, Ida., has ores blocked out and can ship as soon as road is put in condition. At Alice mine, shaft is down to 600 level but no mining is yet done. Ore is being broken in upper levels of Lexington and will be shipped upon completion of concentrator at Washoe reduction works.

Lewis and Clark County

ROSE ROCK MINING AND MILLING CO. (Helena)—Will develop six claims in Grass Valley district, four miles northwest of Helena. Veins carry gold, silver, lead and some copper. Near Franklin mine of Cruse estate in Scratch Gravel district. Shaft will be sunk to 300 ft. Hoist good for 500 ft.

Missoula County

MAMMOTH (Bonita)—Will be developed by crosscut 2,000 ft. to attain depth of 800 ft. Seven miles from railroad. Wallace, Ida., men interested. Four cars lead-silver ore shipped previously by owner.

Silver Bow County

ANACONDA (Butte)—The fire in Pennsylvania mine, by which 21 men lost their lives, has been extinguished. All working levels again in operation, producing 750 tons per day.

EAST BUTTE (Butte)—The 800-ton flotation plant is treating tailings from the mill and small additional tonnage from accumulated tailings. Will not erect acid plant at present, as reported.

BUTTE & SUPERIOR (Butte)—May production estimated at 54,100 tons yielding about 16,500,000 lb. zinc, about 300,000 oz. silver and 260,000 lb. lead. Good ore in Jersey Blue claim, both east and west of shaft on 1,100 level.

BUTTE-BALLAKLAVA (Butte)—At present only 50 tons of 3% ore being hoisted daily as against 300 tons up to two months ago. Development carried on below 1,600 level. Shaft down to 1,700 level and ore being blocked out.

BUTTE-ZENITH CITY MINING CO. (Butte)—Sinking shaft at this property, 6 mi. west of Butte. Shaft is 765 ft. deep; will be sunk to 1,000-ft. level; crosscuts will be run to intersect Paint and American veins. Corinthian claim former silver producer.

BUTTE & GREAT FALLS MINING CO. (Butte)—At meeting held May 24 in Great Falls, capitalization doubled to carry on more extensive development. Property in most northern section of Butte district, 6 mi. north of Anaconda Hill. Drift on V. G. vein is now in silver-lead ore; crosscut nearing Genevieve vein.

ELM ORLU VS. BUTTE & SUPERIOR CO. (Butte)—Upon basis of 31,825 tons of ore taken from Elm Orlu ground, Butte & Superior will settle controversy, according to decision handed down, May 29, by Judge Bourquin of the Federal court. War price of zinc will not be used in settlement but average monthly quotations at the time ore was mined and milled. Butte & Superior allowed $5.75 for mining, freighting and milling costs. In addition to value of zinc, $1 per ton of ore will be added in settlement to include other metals extracted with zinc, and simple interest at 8%, all to be paid by Butte & Superior to Elm Orlu.

NEVADA

Clark County

GREEN MONSTER (Goodsprings)—Shipping zinc-carbonate ore encountered on 300-ft. level. Road over Wilson Summit will shorten haul to railroad; motor trucks being used.

BONANZA (Goodsprings)—Root Mining Co. incorporated to take over property, 8 mi. west of Goodsprings. Ore is high-grade zinc carbonate; 15 cars shipped first three months of year, netted owners over $50,000.

Esmeralda County

C. O. D. CONSOLIDATED (Goldfield)—Ellsworth & Morris lease on Gold Bar and Victor claims recently shipped carload of 5% copper ore.

JUMBO EXTENSION (Goldfield)—Velvet or No. 2 shaft soon to become main working shaft; spur track laid to new ore bins being erected at the collar.

GOLDFIELD CONSOLIDATED (Goldfield)—Final report for April shows 30,400 tons treated at net profit of $60,041. Total operating costs, $5.11 per ton; net costs, $4.94 per ton.

YELLOW TIGER (Goldfield)—Shaft unwatered and being retimbered. Denver office states adjoining ground of Red Lion company will be developed through 700-ft. level, Tiger shaft.

GREAT BEND (Goldfield)—On 400-ft. level, drifts continue in low-grade quartz. At point 260 ft. east of shaft, raise started to connect with old lease workings.

ATLANTA (Goldfield)—Ore shipments suspended. Developments continue on lower levels; considerable tonnage copper-gold ore being blocked that may be profitably treated by flotation.

HORN SILVER MINING CO. (Hornsilver)—After idleness of 18 months, development resumed with crew of 10 men. Some ore of shipping grade being extracted from surface workings west of main shaft.

NEW JERSEY (Goldfield)—At Exchequer shaft, development proceeding on third, fourth and fifth levels. Ore of good grade being hoisted for shipment and milling ore being developed in this property in eastern section of camp.

SILVER PICK (Goldfield)—As result of encouraging assays obtained from core drilling operations at shale-contact horizon, contract let to sink main shaft to 1,000-ft. level. Core drill being reassembled on 500-ft. level west to prospect Phelan vein.

PIONEER CONSOLIDATED (Pioneer)—Mill treating about 30 tons per day; about 65% saved by amalgamation and tailing impounded. Stopes on 110-, 170-, and 250-ft. levels vary from 10 to 30 ft. in width. Some ore being sacked for shipment. Plan to enlarge mill.

Lincoln County

DORIS (Pioche)—Cyanide plant resumed after installing rolls and other additional equipment.

CONSOLIDATED NEVADA-UTAH (Pioche)—Two cars of zinc concentrates shipped recently. Plant treating 60 tons per day, about half from mine and rest from dumps.

Nye County

TONOPAH ORE PRODUCTION for week ended May 27 was 9,400 tons compared with 9,520 tons for week previous. Producers were: Tonopah Belmont, 2,990 tons; Tonopah Mining, 2,800; Tonopah Extension, 1,850; Jim Butler, 750; West End, 650; Rescue-Eula, 210; Halifax, 150 tons.

JIM BUTLER (Tonopah)—April profit was $31,671.45 from 3,272 tons of ore shipped to Tonopah-Belmont plant at Millers.

TONOPAH BELMONT (Tonopah)—April profit was $103.300 from milling 12,335 tons having net value of $168,493. Bullion production was 2,458.92 oz. gold and 232,268 oz. silver.

GIPSY QUEEN (Tonopah)—New pumping equipment on 1,350-ft. level now installed and three shifts sinking shaft to 1,500-ft. point, where lateral development will be undertaken.

TONOPAH EXTENSION (Tonopah)—April profit amounted to $89,863 from treatment of 7,232 dry tons; net value of $160,-154. Bullion production was 1,634 oz. gold and 175,184 oz. silver.

TONOPAH MINING (Tonopah)—April profit $50,100 from 7,364 tons; average value $17.26 per ton. In the Sand Grass claim on 1,260-ft. level, northerly crosscut encountered extension of Murray vein; ore good milling grade.

AFTER ALL MINES CO. (Tonopah)—New company formed to take over Umatilla ground and an equal adjoining area of Montana-Tonopah. Will be prospected from the 1,540-ft. level of the Victor shaft of the Tonopah Extension.

RESCUE-EULA (Tonopah)—Winze down 28 ft. in ore but sinking suspended pending placing of power hoist at collar. No. 4 raise showing 6 ft. of good ore. Drift from No. 1 raise has connected with Belmont workings in Occidental claim.

CALIFORNIA & TONOPAH (Tonopah)—Being worked under option by Tonopah Mining Co. Temporary ore bins erected and stopes on third level producing about two cars of milling ore per week. Drifts on 600-ft. level continue in quartz returning low assays.

MACNAMARA (Tonopah)—President Joseph L. Joseph recently visited property to determine advisability of resuming milling operations at company's plant. Tonnage available for profitable extraction at present silver prices. Property now operated through West End shaft.

Mineral County

SHIPMENTS being made from Luning by following mines: Mayflower, Never Sweat, Turk and Wall Street, Silver Guardian, Vacation, Champion, Anderson, Wedge Copper, Hartwick, Houghton, Luning Aviator, Copper Queen, Finney and Shipper. About 300 men working in district.

R. B. TODD MINING CO. (Luning)—Meyer tunnel in 314 ft.; crosscut south encountered ore. Robert B. Todd, Reno, Nev., manager.

LUNING-IDAHO MINING CO. (Luning)—McDavitt shaft down 100 ft. on foot wall. Left ore at about 60 ft. and crosscut will be run at 100-ft. level. Conte winze is down 25 ft., showing high-grade carbonate and sulphide. Hahn tunnel will be extended to hanging-wall contact.

Storey County

ALPHA AND EXCHEQUER (Virginia)—Joint west crosscut advanced 5 ft. through hard quartz.

ANDES (Virginia)—Sampling old workings near the shaft; saved 8 cars of ore from intermediate level.

CON VIRGINIA (Virginia)—South drift advanced to 123-ft. point; vein continues full width of drift; large amount of quartz coming in.

COMSTOCK PUMPING ASSOCIATION (Virginia)—Continued repairs to Union shaft and prepared to install new discharge column below the 2,000 level in the C. & C. shaft.

OPHIR (Virginia)—Cleaning out and repairing 2,500 and 2,400 levels in progress; blower installed. North drift on 2,700 level advanced to 100-ft. point, face in quartz of fair assay.

SIERRA NEVADA (Virginia)—South drift on 2,500 level advanced; face shows quartz of average assay value $12 per ton. Winze, in No. 1 stope, sinking and timbering reached 87-ft. point; bottom in quartz of fair assay.

MEXICAN (Virginia)—North drift on 2,500 level advanced to the 32-ft. point; face in porphyry and quartz of low assay. West crosscut on 2,700 level advanced 12 ft., face all in quartz. Mexican mill received 391 tons of Union ore, averaging $41.62 per ton.

UNION CON (Virginia)—Extracted 391 tons; gross value more than $16,000. From 2,400 level stopes saved 156 tons, averaging $51.16 and 108 tons, $47.90; 2,500 level 127 tons, $16.51. North drift on 2,700 level advanced to 22-ft. point; face in quartz of fair assay. Union shaft reopened to the 2,500-ft. point.

NEW MEXICO

Dona Ana County

FULLER'S EARTH discovered 12 mi. northwest of Las Cruces by Robt. E. Nix and associates, of El Paso.

Grant County

ECLIPSE (Steeplerock)—Now shipping high-grade ore; George Kalar, president.

CARLISLE (Steeplerock)—New 50-ton mill operating; ore averages $1.50 Au, 3 oz. Ag, 1½% Cu, 7% Pb and 7% Zn.

JIM CROW IMPERIAL (Steeplerock)—Few tons recently shipped from 200-ft. level averaged 9 oz. gold, 500 oz. silver and 2% copper. Geo. H. Utter, of Silver City, owner.

EMPIRE ZINC (Cleveland)—Flotation mill will be built to handle tailings from Cleveland concentrator; car of concentrates shipped daily; force soon to be doubled.

HANOVER BESSEMER IRON AND COPPER CO. (Fierro)—Will erect first unit of large concentrator to recover copper contained in the iron ore. B. E. McKechnier, general manager. Philadelphia men interested.

SOUTHWESTERN NEW MEXICO (Hachita)—New organization to develop recent discovery of rich lead ore in Big Hatchet Mountains; 2-ton auto-truck hauls ore to Hachita, 30 mi. north; T. J. Barnes, who made discovery, is manager.

Otero County

SHIPMENTS from Jarilla camp in April were 3,300 tons.

Sierra County

CARMEN (Hermosa)—J. H. Whitman opened new vein high in gold and silver.

CABALLO MT. MINING (Cutter)—Shipping about six carloads 6½% chalcopyrite ore monthly, mostly from Marion mine; working 15 men. Situated in Caballo Mountains, 15 mi. west of Cutter; force to be increased; Foster G. Smith, general manager.

NEW YORK

AMERICAN SMELTING AND REFINING (New York)—Activity in mining industry assures plants of this company of practically all the ore they can handle this year. Notwithstanding that no revenues are expected from Mexican properties, "Boston News Bureau" estimates earnings of company for first five months of 1916 at rate of 25% per year on common stock. Company now has in hand greatest campaign of enlargement in its history. Fully $6,000,000 being expended this year on plant additions; greatest enlargement at Baltimore copper refinery, but Tacoma and Perth Amboy plants also being increased, bringing total refining capacity up to aproximately 1,000,000,000 lb. per annum. Tin smelting and refining plant at Perth Amboy now operating at about half capacity will gradually increase its operations as supplies of Bolivian tin concentrates are assured. Sasco copper smeltery, recently purchased in Arizona, being brought up to capacity, and enlargements in progress at El Paso and Hayden plants.

TEXAS

TEXAS STEEL CO. (Beaumont)—This company, recently organized by Beaumont men, will develop iron deposits in Cass, Marion and Upshur Counties, and may build reduction plant near Beaumont. Test shipment of 5,000 tons to Eastern furnaces ran over 56% Fe. S. G. Burnett, interested.

UTAH

Beaver County

PALOMA GOLD & SILVER (Milford)—Shaft is being sunk 3½ ft. daily. Carbonate lead ore is being drifted on from 400 level. Lead-silver ore opened, 200 level, north of shaft.

Box Elder County

LAKEVIEW (Saline)—May shipments amounted to 16 cars; 14 zinc and two lead. Promising lead ore opened in southern end of property. Main tunnel in over 1,200 ft.; 90 men employed by company and 50 by lessees.

UNITED PROMONTORY (Saline)—Crosscutting, from bottom of 100-ft. shaft, opened rock mineralized with stringers of copper, lead and silver. Property is seven miles from station. There is considerable activity in this end of district.

Juab County

TINTIC SHIPMENTS during May amounted to 928 cars; for week ended May 26, 261 cars.

DRAGON CONSOLIDATED (Silver City)—Shipped 147 cars in May. High-grade and milling ore are being shipped; also about 340 tons of iron ore daily.

TINTIC MILLING (Silver City)—The second car of concentrates has been shipped. Present capacity of the mill is 80 to 100 tons daily; may be enlarged.

OPOHONGO (Mammoth)—Settlement made on car of ore, averaging 7.73% copper, 80c. gold, 6.6 oz. silver per ton, which brought $1,030; shipped by lessees below 700 level.

COLORADO CONSOLIDATED (Silver City)—Deep work will be undertaken and the Beck Tunnel shaft sunk to 1,600 level in hopes that quartz opened on the 1,100 level will be found.

Salt Lake County

UTAH COPPER (Bingham)—April production amounted to 14,557,282 lb. copper.

SOUTH HECLA (Alta)—Ten cars shipped week ended May 26. Plan to increase shipments to two cars daily.

SELLS (Alta)—Reorganized and directorate increased from five to seven. Ezra Thompson, is president. Active development will be carried on. Ore is being shipped.

ALTA TUNNEL & TRANSPORTATION (Alta)—Has purchased 65 acres of patented ground adjoining the Emma, Flagstaff, and Prince of Wales. Drainage and transportation tunnel now in 2,000 ft. will be extended another 1,000 ft. Tunnel should cut at right angles fissures that have been productive in upper workings.

UTAH METAL & TUNNEL (Bingham)—Almost all of Bingham-New Haven stock exchanged for Utah Metal, and old company will be dissolved in near future. Shipping 100 tons crude ore daily and treating 225 tons. Flotation may be installed. High-grade ore is being shipped from both the Bingham-New Haven and Utah Metal. Drifting started from 750 level of Bingham-New Haven to search for continuation of Utah Metal orebody.

Summit County

PARK CITY SHIPMENTS during May amounted to 8,214 tons of crude ore and concentrates.

THREE KINGS (Park City)—No. 1 fissure is being followed in shaft on 540-ft. level.

AMERICAN FLAG (Park City)—Aleck Lytts, a Finn, killed May 27 by falling 400 ft. down shaft from 700-ft. level.

SILVER KING CONSOLIDATED (Park City)—Road is open and shipments of 60 tons daily being made. Second-class ore opened on 1,800 level—lowest of mine. Machinery ordered for new mill and for 10,000-ft. aërial tram. Grading being done for new compressor and machinery to be installed on site of proposed new tunnel.

Tooele County

STOCKTON STANDARD (Stockton)—Recently organized to work eight lead-silver claims. Drifting from bottom of 200-ft. shaft to cut orebearing fissure. Shaft sunk 70 ft. on vein further up hill.

Utah County

IN AMERICAN FORK, with the opening of roads, more properties are being operated; these include the Belerophon, Bay State, Earle-Eagle, Texan, Live Yankee, etc. Preparations for work are being made at the Major Evans, Boley, Smuggler, and Globe Consolidated. The strike at the Pacific has stimulated activity. Here vein has been followed for several hundred feet. Shipments of lead-silver ore of good grade being made from winter accumulation.

WISCONSIN

Zinc-Lead District

FRONTIER (Benton)—The 200-ton mill on Hird lease now ready.

STANDARD METALS CO. (Cuba City)—Completing 100-ton mill on Anthony mine.

LITLE GIANT (Shullsburg)—The 50-ton mill put in operation by Wherry & Streicher.

MONMOUTH (Hazel Green)—A 200-ton mill has been built on old Murphy tract. Cost, $12,000.

GRAND VIEW (Benton)—A. P. Craft and associates have built 100-ton mill on this property north of Benton.

BLOCKHOUSE (Platteville)—New shaft penetrated seven "sheets" of high-grade jack in 10 ft. of ground; 200-ton mill just completed; property, formerly the Cruson, abandoned 6 yr. ago; Kistler and Stephens, owners.

CANADA

British Columbia

GRANBY (Anyox)—Smelted 76,000 tons in April, highest monthly tonnage yet attained. Four furnaces in operation. Ores from Midas mine in Alaska will be received in June. At Anyox, Hidden Creek reserves have been increased; present ore supply comes from 150 ft. above sea level, but diamond-drill exploration has been done to 150 ft. below sea level.

Ontario

DOME (Porcupine)—May bullion, $189,000 from 39,400 tons, average value $4.80 per ton.

KERR LAKE (Cobalt)—Option on Smith-Labine claims in Sesekinika extended.

R. A. P. (Boston Creek)—High-grade ore showing free gold struck in shaft at 157 ft. Vein widening.

BENNY HOLLINGER (Boston Creek)—A 2-ft. vein opened for 200 ft., has spectacular showings of free gold.

SUCCESS (Porcupine)—At 200-ft. level, vein No. 1 has widened to 18 in. and high assays have been obtained.

HOLLINGER RESERVE (Porcupine)—Purchased by B. McEnaney, who is supposed to represent Benjamin Hollinger.

GILLIES LIMIT area of over 7,000 acres thrown open for prospectors June 1, but there was no rush to stake. Only five claims recorded on first day.

OPHIR (Cobalt)—Diamond drilling disclosed Keewatin-diabase contact at a depth of 600 ft. Working agreement made with People's mine, adjoining, to use latter's shaft.

MEXICO

SANTA GERTRUDIS (Pachuca)—Milled during first quarter, this year, 67,352 tons; estimated profit, about $275,000; mill averaged 67% capacity for quarter, but 78% in March. General manager reports labor supply improving; scarcity of timber remedied by renting special trains to bring regular amount from El Oro district; good stock of all other supplies. Interesting experiments conducted with ball-mill grinding and flotation. Crosscut mineralized wall rock, North vein, 16th level, for 53 ft.; assayed 1.56 dwt. gold and 13.2 oz. silver. In April, milled 23,148 tons.

SALVADOR

BUTTERS SALVADOR (San Sebastian)—Treated in April 3,525 tons; heads, $15.35; residues, $2.12 per ton. Profit, $23,000.

AFRICA

FANTI CONSOLIDATED (19 St. Swithins Lane, E. C., London)—On the Dagwin Extension property, about 30 mi. from the port of Sekondi and only a few rods from the Gold Coast Government Ry., West Africa, important find of high-grade manganese was made.

CHOSEN

KUHARA MINING CO. (Kapsan)—Purchased Collbran copper mine for 3,000,000 yen; the products are to be taken to company's Saganoseki (Japan) works for treatment.

ORIENTAL CONSOLIDATED (Unsan)—April bullion, $143,701, divided as follows: Tabowie mill, $29,146; Taracol mill, $26,786; cyanide plant, $58,029; Maibong mill, $24,806; tube mill, $4,934. Completed tree planting for present year, having set out 175,000 acacia, larch and pine trees. Cordwood railway reopened. Cable estimate, May cleanup, $133,000.

The Market Report

Metal Markets

NEW YORK—June 7

During the last week the principal markets were irregular. Spelter, which previously had been weakest, halted in its decline and rallied feebly. Lead replaced it as the particularly weak feature. Copper was very dull and but little changed from the previous week.

Copper, Tin, Lead and Zinc

Copper—Copper experienced another dull week. Some of the largest agencies reported no inquiry whatever. There were a few transactions of million-pound and two million-pound lots, but any seller was lucky to book more than one of these and there were several days when there were no reported transactions, and quotations but nominal. The premium for prompt copper has entirely disappeared and sellers during the last week made no difference in prices for June copper and for July-December contracts, provided they had the copper to sell. There were intimations, however, that sellers would be glad to dispose of distant futures at material concessions.

The recent lull in buying is explainable in part by the overpurchasing of Connecticut manufacturers a few months ago when the freight embargo was in effect. The New Haven railway officials have called attention to the tendency of consumers at that time to buy and put on the cars more material than they really needed, with the hope of getting some of it through promptly. Certain copper manufacturers appear to have done just that thing. This also explains why certain of them have lately been willing to resell copper.

Copper Sheets are unchanged at 37.5c. for hot rolled and 38.5c. for cold rolled. Copper wire is 33@33½c. per lb. for large lots at mill.

Tin—Business was very dull, both as to spot and futures. The price receded a little from day to day until June 7 when there was a slight rally.

Lead—The reduction by the A. S. & R. Co. to 7c. on June 3 was foreshadowed by the cutting of prices by the independent producers that had been going on for some time previous. Sentiment had been bearish and very little business had been done. The principal producer therefore made a sharp cut, which, of course, was immediately met by the independents. At the new level there was an improvement in demand as compared with the previous week, and some round lots were booked. The market was, however, irregular, one producer reporting a fair business, another large producer reporting considerable inquiry but relatively little business done and three other producers reporting neither much inquiry nor much business. It is certain that some shading of price began again on June 6. It is noteworthy also that while there were tonnage transactions of prompt and near-by lead in the St. Louis market at 6.85c. on that day, tonnages for July-August-September shipment were offered at 6⅝ cents.

There was some export business in lead done during the last week and an increase in the foreign demand is hoped for. The statistical position of the metal is still regarded as very good. Some of the large producers carried over into June nothing in excess of their normal safety reserve. It is believed, therefore, that any considerable renewal of demand might cause a sharp rally in lead. On the other hand, if demand of good proportions fails to materialize the price is likely to crumble away further. For the immediate time the policy of the important producers is to await developments.

Spelter—The decline in this metal reached a point where buyers, both speculative and consuming, became interested, and upon their appearance in the market there was promptly a stiffening of price. Business of fair proportions was reported during the week—large in comparison to what it had been for several weeks previous, but short of what would be necessary to dispose of the average weekly production. There was considerable inquiry from galvanizers and some sales were made to them. There were also some small export sales.

A large part of the buying appeared to be, however, short covering by traders and producers. With regard to the latter it seemed that some of the concerns building new plants, estimated to be producing about this time, had previously disposed of their expected June production. Through delays in completion of their works, which are apt to happen, they were short of metal with which to fill their contracts and took advantage of the favorable opportunity to cover in the open market. The considerable volume of business done for June and June-July delivery is explained to some extent in that way. The supply of June metal being still rather scarce, or anyway in strong hands that are disinclined to sell for what they consider low prices, the market advanced rather more on early deliveries than on the later.

On the whole, the rally was feeble, and the lower quotation coming from London on June 7 put a damper on bullish sentiment. There were sellers right through the week of spelter for delivery during the last half of the year at 11½c.,

DAILY PRICES OF METALS IN NEW YORK

June	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Ctc. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
1	4.7575	68¼	27 @27½	45½	7.15 @7.35	7.00 @7.20	11.75 @12.25
2	4.7581	64¼	27 @27½	45½	7.05 @7.25	6.90 @7.10	11.75 @12.50
3	4.7575	64¼	27 @27½	45	7.00	6.92½	12.00 @12.75
5	4.7575	66½	27 @27½	44¼	6.80 7.00	6.80 @6.90	12.00 @12.75
6	4.7575	66¼	27 @27½	44¼	6.95 @7.00	6.80 @6.90	12.00 @12.75
7	4.7575	66¼	27 @27½	44¼	6.90 @7.00	6.75 @6.90	12.00 @12.75

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts,etc. The price quoted for copper on "regular terms" (r.t.) is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are as reported by Handy & Harman and are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

June	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
1	32⅞	120	118	140	29.81	187¼	187	31½	6.76	75	15.97
2	31	120	118	140	29.81	185¼	185¾	32	6.81	70	14.90
3	31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5	31⅞	124	120	142	30.24	183½	183½	31½	6.70	73	15.54
6	31 11/16	124	121	142	30.24	183	183¼	32	6.81	76	16.18
7	31 11/16	124	120	142	30.24	184½	184¾	32¼	6.86	73	15.54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £ 15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

and during the last quarter, at 11c., which prices were about the same as in the previous week.

High-grade spelter was quoted on June 7 at 24@25c., and brass special at 15c. There was a fair demand for these superior metals, but supply was manifestly increasing.

Zinc Sheets are easier. The base price was reduced on June 3 to $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—June 7

Aluminum—Business continues on a good scale, demand being mainly satisfied by contract deliveries, or by the principal maker. The quotations continue unchanged at 58@60c. per lb. for No. 1 ingots, New York.

Antimony—The market remains dull with practically no business during the week; but, although prices are lower, the tone of the market is steadier, as a result of various reports about big inquiries from abroad and a general feeling that there is no immediate chance of cessation of war and that therefore buying of antimony in considerable quantity is probable. Spot is quoted at 22@24c. per lb.; shipment from China within one month 19@21c. per lb. c.i.f., New York, duty unpaid.

Nickel—The market continues steady with about the same amount of domestic business as usual and with rather a brisk demand for export. Quotations are 45@50c. per lb. for ordinary forms, according to size and terms of order. Electrolytic nickel brings 5c. per lb. premium.

Quicksilver—The market shows some improvement in sales and demand, but prices are again easier. The New York quotation is $70 per flask of 75 lb. for large lots; $70@74 for smaller orders. San Francisco reports by telegraph $74 per flask on a quiet market. These prices are below the parity of London, where £6 10s. per flask is still the price. The difference is almost enough to induce exports; but there are no very large stocks to draw upon.

Gold, Silver and Platinum

NEW YORK—June 7

Gold—More shipments were received from Ottawa last week bringing the total on this movement up to over $30,000,000. It is reported that the Bank of England gold reserve at Ottawa has been increased by a large shipment from Russia. Exports from New York for the week included $1,000,000 gold coin to Cuba.

Gold in the United States June 1 is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,476,127,809; in Treasury current balances, $219,304,336; in banks and circulation, $636,062,689; total, $2,331,494,834, being an increase of $416,708,838 over June 1 last year.

Coined Silver in the United States June 1 is estimated by the Treasury Department as follows: Standard dollars, $568,270,900; subsidiary coins, $187,401,488; total, $755,672,388. Of the standard dollars $490,002,678 are held in the Treasury against silver certificates outstanding.

Silver—The market is quiet after the decline from 32⅞d. Both China and India are reported as sellers, and though the feeling has rather favored an advance, no marked change is in sight at present.

Platinum remains dull with transactions on a very moderate scale. There has been no material change and quotations are around $80 per oz. for refined platinum. Hard metal is $84@86 per oz., according to quality.

Zinc and Lead Ore Markets

JOPLIN, MO.—June 3

Blende, high price $92.90; per ton 60% zinc, premium ore, $90; medium grades, $80@70, and lower grades down to $60; calamine per ton 40% zinc, $60@50; average settling price, all grades of zinc, $77.77 per ton. Lead, high price $93.95; average settling price, all grades of lead, $92.16, purchased at $92.50 per ton 80% metal content; the price today for future delivery is $82.50 base.

SHIPMENTS WEEK ENDED JUNE 3

	Blende	Calamine	Lead	Values
Totals this week	11,892,010	1,103,050	1,981,490	$596,630
Totals this year.	308,283,500	26,035,130	52,300,560	19,921,390

Blende value, the week, $474,690; 22 weeks, $16,571,720.

Calamine value, the week, $30,660; 22 weeks, $958,190.

Lead value, the week, $91,280; 22 weeks, 2,390,880.

Men at hoists went out today at probably a half dozen mines, and their places were immediately filled at two. I. W. W. walking delegates attempted to repeat the action of a year ago, by getting a number of the strikers to start out and carry everything with a hurrah. One mine was closed and they passed to a second, but without augmenting their forces. Instead the men thrown out followed them and joined the men thrown out at the second mine in a hand to hand engagement, driving off the I W. W. with rocks and turning them over to officers. Resident miners with families have not forgotten a year ago, and it is unlikely the strike will gain much headway.

PLATTEVILLE, WIS.—June 3

The base price paid this week for zinc ore was $77@78 per ton for top grades down to $70 base for medium grades. The base price paid for 80% lead ore was $88 per ton.

SHIPMENTS, WEEK ENDED JUNE 3

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,716,000	87,710	605,300
Year	98,426,000	3,576,230	26,196,100

Shipped during week to separating plants, 6,342,000 lb. zinc ore.

MONTANA ZINC ORE

Butte & Superior's production of blende concentrates in May was 15,200 tons, compared with 12,080 in April, 12,190 in March, 10,775 in February and 10,535 in January.

OTHER ORES

Antimony Ore—No change in a dead market; no new business reported; price remains purely nominal at $2.50 per unit.

According to the correspondent of the London "Mining Journal," the exports of antimony ore from Bolivia increased from 186 metric tons in 1914 to 17,923 tons in 1915. He adds: "It will not be surprising to learn that the output of 1915 is doubled in the present year, sale contracts at good prices, 10s. 6d. per unit, having been made up to December shipments. A fair quantity is being shipped to the States. An average assay value of the ores may be taken at 63% Sb. The mines are still all superficial, with little or no methodical development and preparation of reserve stoping ground, but the fever for denouncing and working antimony deposits continues, and will not abate while the war, and consequently the high price, exists."

Tungsten ore shipments from Bolivia were 755 metric tons in 1915, being nearly three times as great as in 1914. At the present time it is reported that nearly 300 tons per month are being produced, most of it going to the United States.

The market has not changed. Consumers are still holding back and sellers will not yet accept the lower offers made. Bids are reported from $30 up to $50 per unit, but no sales, so that the market is entirely nominal.

A consular report from Bangkok notes the discovery of tungsten ore deposits in the district of Nakor-Sri-Tamarat in Siam. The deposits appear to be extensive, and have an abundant supply of water for concentration. They are near the line of the Southern Extension of the Siamese Ry., now building.

Manganese Ore imports at Baltimore for the week were 1,299 tons from India and 7,600 tons from Brazil; also 3,955 tons from Great Britain.

Iron Trade Review

NEW YORK—June 7

The steel market has grown still quieter so far as domestic business is concerned, and sales offices are settling down to the prospect of a dull summer. Specifications against contracts have decreased, but are probably still running somewhat in excess of the shipments, which are substantially at record rate. The general buying movement in steel is certainly over and there is no prospect of a resumption of general buying in near-by months. It is believed that the volume of business now on books will easily carry the steel mills with full operation into the early months of next year, though this expectation assumes that there will be enough business coming out from month to month to take care of the smaller mills, which do not make a practice of filling far ahead. With actual orders and contract obligations the large mills are already taken care of to the end of the year in most cases.

Steel prices are stationary. No declines are expected within the next few months, if at all this year, while there is no influence likely to advance prices farther.

Exports from Baltimore for the week included 1,731 tons steel rails, 68 tons rail joints and 2,266 tons steel billets to France; 1,000 tons old rails to Italy; 4,193,052 lb. iron and steel to Liverpool; 12,135,734 lb. plain and barbed wire to Vladivostok, Russia.

PITTSBURGH—June 6

The steel market has grown still quieter. The mills express the view that the usual summer dullness has started a few weeks earlier than usual but there is no doubt that the high prices and the well-covered condition of buyers are responsible. Railroad buying has ceased entirely, except for the filling of occasional fresh wants in car-repair material and track supplies. In structural work investment undertakings have practically disappeared and there is no longer much railroad work, but there is a fair run of structural for works extensions.

Large premiums continue to rule on plates for early deliveries, but in other directions premium prices are less in evidence, and it is seldom that premiums are paid on bars and shapes. The pipe mills have had very large bookings, continuing to date, and are unable to make shipments as rapidly as desired. Tinplate has become extremely scarce for prompt shipment, there being scarcely any offerings, and it is said as high as $6 might be obtained, forward deliveries easily commanding $5.50, while the season price was $3.60, and 90% of the tonnage involved in season contracts is already specified.

The outlook is for practically unchanged prices for months to come, with probably no general readjustment this year. It is improbable that prices will go any higher except perhaps on a few commodities. The large mills are comfortably fixed for full operation into 1917 but most of the smaller mills will have to book additional business of consequence within three months to maintain operations.

The coal strike in the Pittsburgh district has forced many of the steel works to buy prompt coal, West Virginia being the chief seller, at prices up to the equivalent of $2 at Pittsburgh district mines. Some of the miners are now going back to work, pending a settlement, and the market may be easier.

Pig Iron—The market continues very quiet. There is considerable new export inquiry for bessemer, but not much is being closed, buyers evidently waiting to see if there will be any further decline in ocean rates, which until the past fortnight were prohibitive. Inquiries for basic are infrequent while foundry iron inquiry is generally limited to lots of carloads to 200 tons. A few odd lots of resale southern iron have been offered at the particularly low price of $14, Birmingham, which would easily put the iron into Pittsburgh at under Valley prices, an unusual alignment. W. P. Snyder & Co. report average prices for May, based on actual transactions reported to them, at $20.833 for bessemer, an increase of 13.3c., and $18.1607 for basic, an increase of 16.07c. There was 15,000 tons of basic sold to Republic at $18,, as recently reported, and there is room for surmise that practically all the other sales were at $18.25. The average quotation on foundry iron in May was $18.50, Valley. We quote: Bessemer, $21; basic, $18.25; foundry, $18.50; malleable, $18.25@18.50; forge, $18, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Steel—The market has eased off further, as one or two at least of the large mills would now sell definite tonnages for regular delivery at $40@42, the range at which odd lots of prompt have lately been selling. For some time the market was $45 minimum for any delivery, and practically nominal at that. Rods are $55@60 and forging billets $65@70 per ton.

FERROALLOYS

Ferromanganese—The market continues quiet. There is little demand for spot, but on account of scarcity the market keeps up to about $325. Contract remains at $175, with only 1917 deliveries offered. Some sales of domestic are reported at $275@300 per ton for early delivery.

It is learned that representatives of English makers of ferromanganese have been advised that deliveries to this country henceforth will be handled through the British consul general at New York instead of by private firms, which had been acting in such capacity under special arrangement with the British Admiralty. A similar change will apply in the case of spiegeleisen, manganese ore and such other products as may be shipped here from the British Isles. The distribution of ferromanganese through representatives of the British Government in this country has been followed in order to serve the purpose of the latter to prevent any of these shipments or the steel into which they enter from being used to the benefit of enemy countries

Spiegeleisen is still nominally $65 per ton for 20% at furnace, but for early delivery up to $90 per ton at furnace is asked.

Ferrosilicon is still nominally $83@85 per ton at furnace for 50%; but premiums of varying amount are asked for early deliveries. Bessemer ferrosilicon is from $33 for 10% up to $43 for 16%, at furnace.

IRON ORE

Shipments of iron ore from the Lake Superior region in May are reported at 8,449,580 tons, a record for that month, and an increase of 3,437,221 tons over May, 1914. For the season to June 1 the total shipments were 10,107,991 tons, an increase of 4,591,800 tons over last year.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 436,812 net tons; shipments, 437,091 tons. Shipments of Greensburg and Upper Connellsville districts were 40,925 tons.

Connellsville—The market for spot furnace coke has stiffened, some sales having been effected recently at $2,75, according to reports, but there have been offerings at $2.50. There have been two or three requests for suspension of shipments on contract, one being due to a strike at two Cleveland blast furnaces. The strength of the market is doubtless due to the coal strike in the Pittsburgh district, about 75% of the union miners having already gone out, with a practical certainty the rest will go out Wednesday. A local convention has repudiated the recent scale settlement and proposes negotiations for a fresh settlement. Already there has been demand for coal from the lower Connellsville region and more is expected. We quote: Spot furnace, $2.50@2.75; contract, nominal, $2.50@3; spot foundry, $3.25@3.50; contract, $3.50, per net ton at ovens.

Pocahontas region reports that the labor shortage in the region is becoming more serious, owing to the steady migration of mine workers to other states and the absence of any important offset in the way of new arrivals. It is reported that Italian miners have been advised by their consuls to seek work in munition plants that are engaged in filling orders for Italy, while the high wages offered for unskilled labor by such establishments also make a strong appeal. The prohibition law is still another factor in causing foreigners to leave, although the operators claim that the men who do remain are more steady and efficient workers as a result of the law.

Coal shipments from Newcastle, N. S. W., by water three months ended Mar. 31 were 1,013,001 tons in 1915; and 777,359 in 1916; a decrease of 235,642 tons.

Chemicals

NEW YORK—June 7

The general market shows a tendency to quiet down as the dull summer season draws near. Heavy chemicals have been slow, though prices are rather firm.

Arsenic—Sales have been fair, but are slowing down a little. Spot brings $6.25@6.50 per 100 lb., according to order, while $6 per 100 lb. is quoted for futures.

Copper Sulphate—Inquiry has been slow, especially for export and sales have been moderate. The market is again easier and $14.50@$15.50 per 100 lb. is quoted for carload lots and over, with $2.50 per 100 lb. extra for small lots.

Nitrate of Soda—There is little change in the market and prices are unchanged, but not very firm, at $3.10 per 100 lb. for spot and $3 per 100 lb. for futures. Imports of nitrate in March were 79,878 tons, as against 21,617 tons in March last year. Shipments from the West Coast are reported for the four months ended Apr. 30 as follows, in gross tons:

To	1914	1915	1916
Europe	587,200	227,700	446,500
United States	226,050	191,050	406,100
Total	813,250	418,750	852,600

The April shipments were 202,600 tons. Quantities afloat on Apr. 30 were 306,900 tons.

Sulphur—Freight rates remain high and there is not very much material for early delivery. Spot is held at $35 per long ton, with $30 asked for futures.

Sulphuric Acid—Trading for the week has been again mainly for small lots, but there are inquiries for some large quantities. The quotations are $22@25 per ton for 60-deg. acid at works. For 66-deg. acid $50 per ton is asked for early delivery and $45 for second half.

PETROLEUM

The monthly report of the "Oil City Derrick" gives new wells completed in May as follows: Pennsylvania grade, 581; Lima-Indiana, 102; Central Ohio, 23; Kentucky, 66; Illinois, 169; Kansas, 477; Oklahoma-Arkansas, 961; Texas Panhandle, 66; North Louisiana, 58; Gulf Coast, 155. The total was 2,658, with an aggregate production of 154,456 bbl. There were 160 gas wells reported and 467 dry holes. On May 31 there were 4,148 new wells in progress.

Assessments

Company	Delinq.	Sale	Amt.
Advance, Mont.	June 15	July 15	$0.005
Algomah, Mich.	May 18	.....	1.00
Alpha, Nev.	June 7	June 28	0.03
Andes, Nev.	May 9	May 31	0.02
Arbroath, Wash.	June 1	July 1	0.002
Best & Belcher, Nev.	June 9	June 28	0.05
Central Eureka, Calif.	June 16	July 14	0.05
Challenge, Nev.	June 12	July 7	0.05
Coeur d'Alene Antimony, Ida.	June 3	.....	0.01
Confidence, Nev.	June 23	July 14	0.10
East Hercules Ext., Ida.	May 1	July 3	0.0015
Emerald, Utah.	June 15	July 8	0.0033
Enterprise, Ida.	May 20	June 20	0.001
Fortuna, Utah.	June 15	July 8	0.005
Giant, Ida.	June 16	July 17	0.003
Goldstrike Bon., Utah.	June 15	July 15	0.01
Idaho & Los Angeles, Ida.	June 2	July 1	0.005
Imperial, Ida.	June 12	July 12	0.005
Leonora, Utah.	June 20	July 11	0.005
Liberty, Utah.	June 15	July 3	0.005
McKinley, Utah.	May 22	June 15	0.0025
National, Ida.	June 2	July 3	0.02
North Franklin, Ida.	June 19	July 8	0.005
North Lake, Mich.	June 14	.....	1.00
Ophir, Nev.	June 13	July 6	0.05
Phedora, Ida.	May 9	July 1	0.005
Rio Grande, Nev.	June 22	July 22	0.002
Rob Roy, Ida.	June 10	July 10	0.002
Roosevelt, Utah.	June 1	July 1	0.02
Silver Cable, Ida.	May 22	June 10	0.005
Silver Star, Ida.	June 14	July 1	0.002
Snowstorm Ext., Idaho.	May 9	June 13	0.003
Sonora, Ida.	June 5	June 30	0.004
Sunset, Ida.	June 3	June 24	0.002
Tarbox, Ida.	May 6	June 20	0.05
Utah Centennial, Utah.	May 20	June 19	0.0025
Uvada, Nev.	June 24	July 27	0.02
Western Pacific, Utah.	May 16	June 6	0.00¼

Stock Quotations

SAN FRANCISCO June 6 Name of Comp.	Bid.
Alta	.04
Andes	.12
Best & Belcher	.07
Bullion	.01
Caledonia	.30
Challenge Con.	.03
Confidence	.12
Cons. Imperial	.01
Con. Virginia	.17
Gould & Curry	.02
Hale & Norcross	.05
Jacket-Cr. Pt.	.07
Mexican	.22
Occidental	.70
Ophir	.24
Overman	.07
Savage	.05
Seg Belcher	.03
Sierra Nevada	.26
Union Con.	.91
Utah Con.	.03
Belmont	4.40
Jim Butler	.96
MacNamara	.07
Midway	.29
Mont.-Tonopah	.25
North Star	.17
Rescue Eula	.45
West End Con.	1.07½
Atlanta	.11
Blue Bell	.01
Booth	.16
C.O.D. Con.	.03
Comb. Frac.	.08
D'field B.B.	.05
D'field Daisy	.03
Jumbo Extension	.88
Pitts.-Silver Peak	.07
Round Mountain	.70
Sandstorm Kendall	.05
Silver Pick	.09
Central Eureka	.06
Argo	.19
Big Jim	.87½
Lazy Boy	.17
Oatman Cres.	‡.42
Oatman No. Star	.17
Tom Reed	1.55
United Eastern	4.37½
United Western	.13

LONDON May 25	
Alaska Tre'dwell	£6 10s 0d
Burma Corp.	2 12 6
Cam & Motor	0 14 0
Camp Bird	0 9 9
El Oro	0 10 3
Esperanza	0 11 6
Mexico Mines	4 2 6
Nechi, pfd.	0 14 3
Oroville	0 16 0
Santa Gert'dis.	0 14 6
Tomboy	1 3 9

SALT LAKE June 6 Name of Comp.	Bid.
Beck Tunnel	‡.22½
Black Jack	.11½
Colorado Mining	.19
Crown Point	.05½
Daly-Judge	7.60
Emma Cop.	.69
Gold Chain	.27
Grand Central	.50
Iron Blossom	1.80
Lower Mammoth	.04
May Day	.14½
Opohongo	‡.02
Prince Con.	1.37½
Seven Troughs	‡.15
Silver King Coal'n	2.90
Silver King Con.	3.10
Sioux Con.	.15
Uncle Sam	.06½
Yankee	.30

COLO. SPRINGS June 6	
Acacia	.03¾
Cripple Cr'k Con.	‡.00¾
Doctor Jack Pot	.10
Elkton Con.	.15½
El Paso	.77
Findlay	.03½
Gold Sovereign	.03½
Golden Cycle	2.06½
Granite	.67
Isabella	.16½
Jack Pot	.06
Jerry Johnson	‡.04
Mary McKinney	.41
Portland	1.74
Vindicator	2.40

TORONTO June 6	
Bailey	.08
Chambers Ferland	.20
Coniagas	4.87½
La Rose	.62½
Peterson Lake	.27
Right of Way	.05
Seneca Superior	.22
T. & Hudson Bay	‡33.00
Temiskaming	.64
Trethewey	.20
Wettlaufer-Lor	.06
Dome Exten.	.33
Dome Lake	.29
Foley O'Brien	.50
Hollinger	29.50
Imperial	.03
Jupiter	.22
McIntyre	1.56½
Porcu. Crown	.87½
Preston E. D.	.03
Vipond	.55
West Dome	.36½

N. Y. EXCH. June 6 Name of Comp.	Clg.
Alaska Gold M.	22½
Alaska Juneau	9
Am.Sm.&Ref.,com	97½
Am. Sm. & Ref., pf.	112½
Am. Sm. Sec., pf. A	95½
Am. Sm. Sec., pf. B.	87½
Am. Zinc	85½
Anaconda	83⅜
Batopilas Min.	2½
Bethlehem Steel	456
Bethlehem Steel, pf.	135
Butte & Superior	92⅜
Chile Cop.	21
Chino	53⅜
Colo. Fuel & Iron	42½
Crucible Steel	84
Dome Mines	27½
Federal M. & S.	17
Federal M. & S., pf.	36
Great Nor., ore ctf.	38½
Greene Cananea	46⅜
Homestake	130
Inspiration Con.	45½
International Nickel	45⅛
Kennecott	53¾
Lackawanna Steel	68½
Miami Copper	35½
Nat'l Lead, com.	67
National Lead, pf.	114
Nev. Consol.	18
Ontario Min.	7¼
Quicksilver	2½
Quicksilver, pf.	3½
Ray Con.	22⅛
Republic I&S, com.	46⅞
Republic I&S, pf.	‡111⅛
Sloss-Sheffield	53½
Sloss-Sheffield, pf.	83
Tennessee Copper	42⅜
Utah Copper	81½
U. S. Steel, com.	83⅛
U. S. Steel, pf.	117½
Va. Iron C. & C.	51

N. Y. CURB June 6	
Adanac	.63
Alta Con.	.61
Beaver Con.	.40
Buffalo Mines	1½
Butte & N. Y.	2½
Butte C. & Z.	6½
Can. Cop. Corpn.	1⅛
Cashboy	.08
Cerro de Pasco	35½
Con. Ariz. Sm.	1⅜
Con. Coppermines	2½
Con. Nev.-Utah	⅜
First Nat. Cop.	4
Florence	.45
Goldfield Con.	.96
Goldfield Merger	.10½
Granite	.40
Hecla Min.	4⅛
Howe Sound	5½
Jerome Verde	1⅞
Kenefick Zinc	13½
Kerr Lake	4⅜
Magma	15½
Majestic	.81½
McKinley-Dar-Sa.	.55
Mines of Am.	2⅜
Mother Lode	.28½
Nevada Hills	.21
New Utah Bingham	‡2⅜
N. Y. & Hond.	17
Nipissing Mines	7½
Oro	.05½
Ray Hercules	3⅞
Rochester Mines	.69
St. Joseph Lead	16½
Standard S. L.	1⅜
Stewart	1/16
Success	.77
Tonopah	6 7/16
Tonopah Ex.	6½
Tribullion	.50
White Knob, pf.	1½
Yukon Gold	2

BOSTON EXCH June 6 Name of Comp.	Bid
Adventure	3½
Ahmeek	399
Algomah	1½
Alloues	67
Ariz. Com., ctfs.	8½
Bonanza	.25
Butte-Ballaklava	2½
Calumet & Ariz.	70½
Calumet & Hecla	547
Centennial	16½
Copper Range	62½
Daly West	2½
East Butte	12½
Franklin	7½
Granby	87
Hancock	‡14½
Hedley	‡20
Helvetia	.30
Indiana	3
Island Cr'k, com.	49
Island Cr'k, pfd.	91
Isle Royale	27½
Keweenaw	4½
Lake	15
La Salle	3½
Mason Valley	2½
Mass	11½
Mayflower	2½
Michigan	3½
Mohawk	95
New Arcadian	6½
New Idria	14
North Butte	23½
North Lake	.75
Ojibway	1½
Old Colony	2½
Old Dominion	69½
Osceola	93
Quincy	94½
St. Mary's M. L.	74½
Santa Fe	2½
Shannon	8½
Shattuck-Ariz.	31½
So. Lake	7½
So. Utah	.25
Superior	31½
Superior & Bost.	4
Tamarack	50
Trinity	5½
Tuolumne	.50
U. S. Smelting	75½
U. S. Smelt'g, pf.	51
Utah Apex	4½
Utah Con.	14½
Utah Metal	8½
Victoria	3½
Winona	5½
Wolverine	55½
Wyandot	1½

BOSTON CURB June 6	
Bingham Mines	13½
Boston Ely	.45
Boston & Mont.	1⅛
Butte & Lon'n Dev.	.72
Calaveras	4½
Calumet-Corbin	.04½
Chief Con.	1⅛
Cortes	.50
Crown Reserve	.50
Davis-Daly	1½
Eagle & Blue Bell	2½
Houghton Copper	1½
Iron Cap Cop., pf.	6½
Mexican Metals	.36
Mojave Tungsten	6½
Nat. Zinc & Lead	2½
Nevada-Douglas	1½
New Baltic	2½
New Cornelia	12
Ohio Copper	.16
Oneco	1½
Raven Copper	.18
Rex Cons.	.29
Rilia	.92
United Verde Ext.	27½

‡Last Quotations.

Monthly Average Prices of Metals

SILVER

Month	New York 1914	New York 1915	New York 1916	London 1914	London 1915	London 1916
January	56.572	48.855	56.775	26.553	22.731	26.960
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241	57.935	26.788	23.708	27.597
April	58.519	50.250	64.415	26.958	23.709	30.662
May	58.175	49.915	74.269	26.704	23.570	35.477
June	56.471	49.034	.....	25.948	23.267	.....
July	54.678	47.519	.....	25.219	22.597	.....
August	54.344	47.163	.....	25.979	22.780	.....
September	53.290	48.680	.....	24.260	23.591	.....
October	50.654	49.385	.....	23.199	23.925	.....
November	49.082	51.714	.....	22.703	25.094	.....
December	49.375	54.971	.....	22.900	26.373	.....
Year	54.811	49.674	.....	25.314	23.675	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic 1915	New York Electrolytic 1916	London Standard 1915	London Standard 1916	London Electrolytic 1915	London Electrolytic 1916
Jan.	13.641	24.008	60.756	88.083	65.719	116.167
Feb.	14.394	26.440	63.494	102.667	*	133.167
Mar.	14.787	26.310	66.152	107.714	*	136.000
April	16.811	27.895	75.096	124.319	*	137.389
May	18.506	28.625	77.600	135.457	*	152.522
June	19.477	.....	82.574	.....	95.333	.....
July	18.796	.....	76.011	.....	91.409	.....
Aug.	16.941	.....	68.673	.....	82.333	.....
Sept.	17.502	.....	68.915	.....	85.250	.....
Oct.	17.686	.....	72.601	.....	88.000	.....
Nov.	18.627	.....	77.744	.....	93.273	.....
Dec.	20.133	.....	80.773	.....	100.43	.....
Year	17.275	.....	72.532	.....	.....	.....

TIN

Month	New York 1915	New York 1916	London 1915	London 1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426	50.741	180.141	193.609
April	47.884	51.230	166.225	199.736
May	38.790	49.125	162.675	196.511
June	40.288	.....	167.636	.....
July	37.423	.....	167.080	.....
August	34.389	.....	151.440	.....
September	33.125	.....	152.625	.....
October	33.080	.....	151.554	.....
November	39.224	.....	167.670	.....
December	38.779	.....	167.000	.....
Av. year	38.590	.....	163.960	.....

LEAD

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053	7.136	3.997	7.375	21.883	34.440
April	4.221	7.630	4.142	7.685	21.094	34.368
May	4.274	7.463	4.182	7.332	20.347	32.967
June	5.932	.....	5.836	.....	25.170	.....
July	5.659	.....	5.531	.....	24.611	.....
August	4.656	.....	4.520	.....	21.946	.....
September	4.610	.....	4.490	.....	23.151	.....
October	4.600	.....	4.499	.....	23.994	.....
November	5.155	.....	5.078	.....	26.278	.....
December	5.355	.....	5.266	.....	28.807	.....
Year	4.673	.....	4.567	.....	22.917	.....

SPELTER

Month	New York 1915	New York 1916	St. Louis 1915	St. Louis 1916	London 1915	London 1916
Jan.	6.386	16.915	6.211	16.745	30.844	89.810
Feb.	8.436	18.420	8.255	18.260	39.819	97.762
Mar.	8.541	16.846	8.360	16.676	44.141	95.048
April	10.012	16.695	9.837	16.525	49.888	99.056
May	14.781	14.276	14.610	14.106	68.100	94.217
June	21.208	.....	21.038	.....	100.614	.....
July	19.026	.....	18.856	.....	97.250	.....
Aug.	12.781	.....	12.611	.....	67.786	.....
Sept.	13.440	.....	13.270	.....	67.841	.....
Oct.	12.800	.....	12.596	.....	66.536	.....
Nov.	15.962	.....	15.792	.....	88.409	.....
Dec.	15.391	.....	15.221	.....	89.400	.....
Year	13.230	.....	13.054	.....	67.553	.....

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer‡ 1915	Bessemer‡ 1916	Basic‡ 1915	Basic‡ 1916	No. 2 Foundry 1915	No. 2 Foundry 1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55	21.81	13.45	19.20	13.95	19.45
April	14.55	21.65	13.45	18.95	13.95	19.45
May	14.61	21.78	13.60	19.11	13.83	19.58
June	14.70	.....	13.67	.....	13.77	.....
July	14.94	.....	13.91	.....	13.68	.....
August	16.01	.....	15.31	.....	14.75	.....
September	16.86	.....	15.95	.....	15.70	.....
October	16.95	.....	15.96	.....	15.80	.....
November	17 57	.....	16.47	.....	17.20	.....
December	19.97	.....	18.44	.....	18.95	.....
Year	$15.82	.....	$14.76	.....	$14.95	.....

‡As reported by W. P. Snyder & Co.